

Idiopathic Pulmonary Fibrosis (IPF) is a progressive, debilitating interstitial lung disease of unknown aetiology that results in irreversible scarring of the lungs. Patients develop impaired oxygen exchange and subsequent functional limitations including dyspnoea, hypoxia and fatigue. Patients' fear of breathlessness leads to avoidance of physical activity yet, exercise is crucial to maintain health, strength, and mobility. Pulmonary rehabilitation is advocated for IPF patients but access to such programmes is difficult and restricted.

**Methods** The Irish Lung Fibrosis Association (ILFA) in collaboration with the physiotherapy department at the Mater Misericordiae University Hospital developed the 2000 Steps a Day Challenge as a new and innovative home-based exercise programme for IPF patients. The 2000 Steps a Day pack includes a pedometer, guidance and a diary to progress the step programme, and a Contract for Success to encourage commitment. Positive language and inspirational messages were used to motivate patients to make it part of their daily routine and reassure and support those experiencing setbacks. The programme was piloted by 15 ambulatory patients (11 male: 4 female) for 4-weeks. 10/15 patients required supplementary oxygen, 6/15 patients were on the lung transplant list and 3/15 patients were post-lung transplant. Patients were asked to record their baseline daily step count for 1-week, to gradually incorporate an additional 2000 steps (equivalent to 1 mile of walking) into their daily routine, and to complete a questionnaire on the suitability of the new exercise programme.

**Results** 12/15 patients completed the pilot phase and successfully added at least 2000 steps extra to their daily routine. 10/12 patients completed the questionnaire. 90% said the written materials were clear and understandable, 70% said the programme was easy to incorporate into their lives, 80% were motivated to exercise every day, 90% considered the pedometer a good motivational tool, 70% found the diary practical, 80% reported improved confidence, 100% felt a sense of achievement after reaching their target, 100% would recommend the programme to another patient. To date, over 200 walking packs have been requested. The ILFA 2000 Steps a Day Challenge is a novel, safe, effective and achievable home-based exercise solution for IPF patients.

## The lungs at work: occupational lung disease

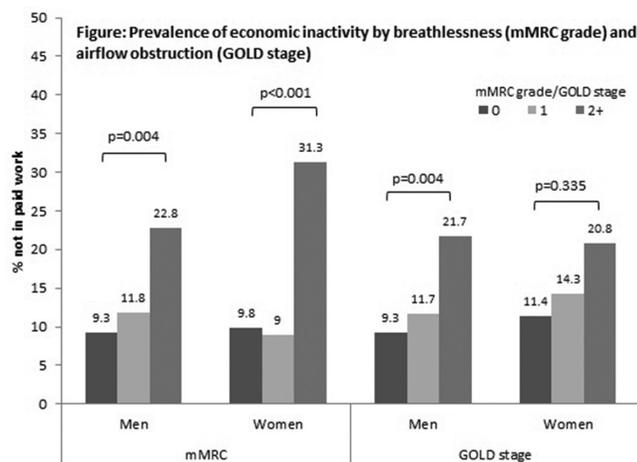
### P126 BREATHLESSNESS AND LUNG FUNCTION PREDICTS FUTURE WORK DISABILITY IN OLDER WORKERS: DETECTION, INTERVENTION, RETENTION?

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Economic pressures and the ageing population have increased the importance of maintaining fitness to work in older adults. Dyspnoea and airflow limitation are associated with disability particularly in individuals with diagnosed disease. A cross-sectional general population survey of 51–60 year olds demonstrated significant associations between breathlessness, airflow obstruction and work performance; a follow-up survey was completed 18 months later to examine changes in work.

Participants from the first study were sent a postal questionnaire asking about job and employment changes. Questionnaire



**Abstract P126 Figure 1** Prevalence of economic inactivity by breathlessness (mMRC grade) and airflow obstruction (GOLD stage)

and spirometry results from the initial study were used to define breathlessness (modified MRC scale) and airflow obstruction (GOLD stage) respectively. Information from the follow up questionnaire was also used to identify cases, defined as those who had experienced a change in employment, and frequency matched controls of the same gender, who reported no change in work circumstances (with a ratio of two controls per case).

Results from respondents to the follow up questionnaire (1663/1773 (94%)), all of whom had been in full time work at the time of the first study) showed that the majority (78.5%) continued in full time employment; however 10.6% were working part time and 10.9% were no longer in paid employment at follow up. Of the participants still in employment who reported changing their hours or activity at work, 9.3% stated that this change had been to their health. Prevalence of economic inactivity rose with increasing breathlessness and with increasing airflow obstruction in workers of both sexes; these relationships were statistically significant in all cases except for airflow obstruction in women (Figure). The odds of GOLD stage 1 or greater airflow obstruction was significantly higher in cases than in controls (unadjusted OR 1.71, 95% CI 1.10–2.77,  $p = 0.02$ ).

These findings suggest that breathlessness and airflow obstruction are associated with subsequent job instability and premature loss from the workforce in older workers. A focused surveillance programme could identify those at higher risk of employment problems with the intention of ameliorating them – providing that there are suitable interventions available to support continuing workforce activity in adults in their sixth decade of life and beyond.

### P127 COPD AND THE WORKPLACE; ATTITUDES OF THOSE WITH AND WITHOUT THE CONDITION IN A POPULATION BASED STUDY

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**Background** Current estimates support 15% of the total population burden of chronic obstructive pulmonary disease (COPD) to be associated with harmful inhaled occupational exposures. Despite a now substantial body of evidence relating to causation, remarkably little is known about the consequences of these

inhaled exposures at an individual level, and the attitudes of workers with and without COPD to these issues.

**Aim** The aim of this work was to explore attitudes to workplaces, and to other aspects of the management of long-term respiratory problems, from individuals within a large population study with and without COPD.

**Methods** The primary aim of this population-based study was to assess the contribution made by inhaled occupational exposures to the development of COPD. The study was based in Sheffield, historically an industrialised part of the UK. A sub sample of cases of self reported COPD (n = 66) and non cases of COPD (n = 224) were asked to rate their views to a set of 36 pre defined statements, each rated between “don’t agree” and “completely agree” on a five point scale. Statements included enquiry about attitudes to chronic respiratory ill health, smoking, general health issues and the influences of the workplace on health.

**Results** 290 individuals, all 55 years old or greater, participated, 172 (59%) of whom were male. The majority of participants generally agreed or completely agreed with most statements, although various differences emerged between those with and without COPD. For example, those with self reported COPD were more likely, as anticipated, to identify this condition as a longer term health problem, but less likely to agree that workers with possible breathing problems should talk to their employer about these or undergo regular spirometry to identify these.

**Conclusions** This study has identified a set of attitudes and beliefs from those with and without COPD relating to chronic respiratory problems at work. Knowledge of these semi-quantitative data will assist the development of better workplace interventions to reduce the burden of this condition.

#### P128 A NEW, EFFICIENT SPIROMETRY-BASED ALGORITHM TO PREDICT RESTRICTIVE LUNG DISEASE IN WORKPLACE RESPIRATORY SURVEILLANCE

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**Introduction and objectives** Spirometry is frequently carried out as part of workplace-based respiratory surveillance programmes for the detection of both obstructive and restrictive lung diseases. However, the performance of spirometry to detect restrictive lung diseases is generally poor and especially so if the prevalence of the disease in the tested population is low such as in many working populations.

Our aim was to increase the specificity and the positive predictive value (PPV) of current spirometry-based algorithms to diagnose restrictive lung diseases in the occupational health setting to reduce false positives and so the number of unnecessary and expensive referrals for lung volume measurements in hospital.

**Methods** We re-analysed two prospective studies of 259 and 265 tertiary care hospital consecutive patients, respectively used to derive and validate the current standard spirometry-based algorithm (FVC <85% predicted and FEV<sub>1</sub>/FVC >55%) to diagnose restrictive lung diseases (Glady CA, *et al.* Chest 2003). We used true lung restrictive cases (TLC <LLN predicted) as a gold standard in 2 × 2 contingency tables to estimate sensitivity, specificity, positive and negative predictive values for each potential diagnostic cut-off. Predicted values for spirometry parameters were calculated by using both Crapo and Hankinson equations. Because our target population is active workers we tested the performance of each diagnostic algorithm among subjects under

65 years old and with a simulated prevalence of restrictive disease of 10% and 1%. In addition, we compared the performance of our best diagnostic algorithm to the ones previously reported by using receiver operating characteristic (ROC) curves.

**Results** Our best diagnostic algorithm (FVC <70% predicted and FEV<sub>1</sub>/FVC ≥ 0.7) had a higher specificity (96% using Hankinson prediction equation) and PPV (80% and 27% for a disease prevalence of 10% and 1%, respectively) compared to previous algorithms. For example, compared to Glady’s algorithm, among 184 people tested, ours produced only 6 (3%) false positives vs. 64 (34%), and correctly classified 91% subjects vs. 65%, corresponding to an area under the ROC curve of 0.83 vs. 0.77. The results were confirmed in the validation dataset.

**Conclusions** Our proposed spirometry-based algorithm accurately excludes pulmonary restriction and reduces unnecessary lung volume testing in occupational health clinical setting.

#### P129 SYSTEMATIC REVIEW AND META-ANALYSIS OF CROSS-SECTIONAL STUDIES ON ARC WELDING FUME EFFECTS AND OBSTRUCTIVE LUNG DISEASE

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**Introduction and objectives.** Exposure to the complex metal-rich aerosol produced by arc welding is putatively linked to obstructive lung disease in welders through a mechanism of oxidative stress. Given that published studies have been mainly conducted by means of cross-sectional surveys, this research aims systematically to review these; we have previously published a similar review of (the many fewer) longitudinal studies on welders’ lung function decline.

**Methods** Medline, Embase and Web of Science were searched up to July 2013 by combining two blocks for exposure (welding fume) and outcomes (FEV<sub>1</sub>, FVC, FEV<sub>1</sub>/FVC%, asthma, acute and chronic bronchitis, dyspnoea and wheezing) both containing free text keywords and MeSH terms. Double data extraction was performed independently. To explore possible causes of heterogeneity a subgroup analysis was undertaken to account for country income level, participants’ smoking status and welders’ age.

**Results** Fifty-six cross-sectional studies were identified and 40 were included in the review. Of these, 35 were included in a meta-analysis; lung function was measured in 22 studies and symptoms in 30 studies. Compared with non-welders, welding was associated with a statistically significant reduction in FEV<sub>1</sub> (SMD = -0.34; 95% CI, -0.57, -0.12; I<sup>2</sup> = 92%) and FEV<sub>1</sub>/FVC% (SMD = -0.51; 95% CI, -0.94, -0.08; I<sup>2</sup> = 96%). The substantial heterogeneity in both outcomes was explored further but no subgroup analyses explained it. FVC reduction with welding exposure was not statistically significant and highly heterogeneous. Welding was associated with asthma (OR = 1.65, 95% CI, 1.14, 2.37; I<sup>2</sup> = 0%), acute bronchitis (OR = 1.61, 95% CI, 1.15, 2.27; I<sup>2</sup> = 11%), chronic bronchitis after excluding a large study<sup>1</sup> (1.92, 95% CI, 1.50, 2.46; I<sup>2</sup> = 40%), dyspnoea in medium/low income countries (OR = 3.54, 95% CI, 1.96, 5.08; I<sup>2</sup> = 0%) and wheezing among non-smokers (OR = 9.06, 95% CI, 3.75, 21.9; I<sup>2</sup> = 0%). All risk estimates for symptoms were higher in medium/low income countries.

**Conclusions** Welding fume exposure has a negative effect on the respiratory health of workers, possibly leading to obstructive lung disease and increasing the risk of respiratory symptoms particularly in medium/low income countries.