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Title: The predictive value of methacholine challenge testing for respiratory symptoms and lung function in aluminium smelter workers

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Body: Aim: To assess the predictive value of a methacholine(MCh) challenge test for the subsequent development of respiratory symptoms, airflow limitation or decline in lung function among aluminium smelter workers. Methods: We conducted an inception cohort study of new employees at two aluminium smelters. Participants completed a modified Medical Research Council(MRC) respiratory questionnaire, spirometry and a MCh challenge test. The primary predictor was baseline bronchial hyper-reactivity(BHR) defined as PD_{20} <20μmol. Outcomes included respiratory symptoms and lung function. Analysis was with longitudinal linear or logistic models utilising generalised estimating equations. Results: Baseline interviews and lung function testing were completed by 308 workers, 243 were followed for a median of 2 years. BHR at baseline was a predictor of incident wheeze (RR 1.56; 95%CI 1.19-2.05) after adjustment for current smoking and work category. BHR was also a predictor of incident chest tightness (1.55; 1.04-2.32) after adjustment for current smoking. BHR at baseline was associated with lower FEV_1 and FEV_1/FVC ratio throughout follow-up. However BHR was not significantly associated with decline in FEV_1, nor with decline in FEV_1/FVC, after adjustment for potential confounders. Whilst the specificity (77%, 75%) and negative predictive value (72%, 81%) of BHR were reasonable, the sensitivity (39%, 42%) and positive predictive value for wheeze and chest tightness (45%, 34% respectively) were quite poor. Conclusion: The findings do not support the use of a MCh challenge test as part of pre-employment or preplacement screening in the aluminium industry.