The occupations at increased COPD risk in the large population-based UK Biobank Cohort

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Background and Aim:

- ~15% of COPD cases are attributable to work; up to 40% among never smokers[1].Occupational risk factors are preventable, but the occupations at incrsead COPD risk are still uncertain.
- In a cross-sectional analysis in the UK Biobank cohort, we found 14 jobs at increased COPD risk[2]. However, only current occupations were available. To progress these findings we developed OSCAR[3], a new web-based tool to efficiently collect and automatically code lifetime job-histories in large population-based studies.
- Our aim was to investigate the association of lifetime occupations with COPD risk in the large population-based UK Biobank study taking into account potential confounders, in particular tobacco smoking.

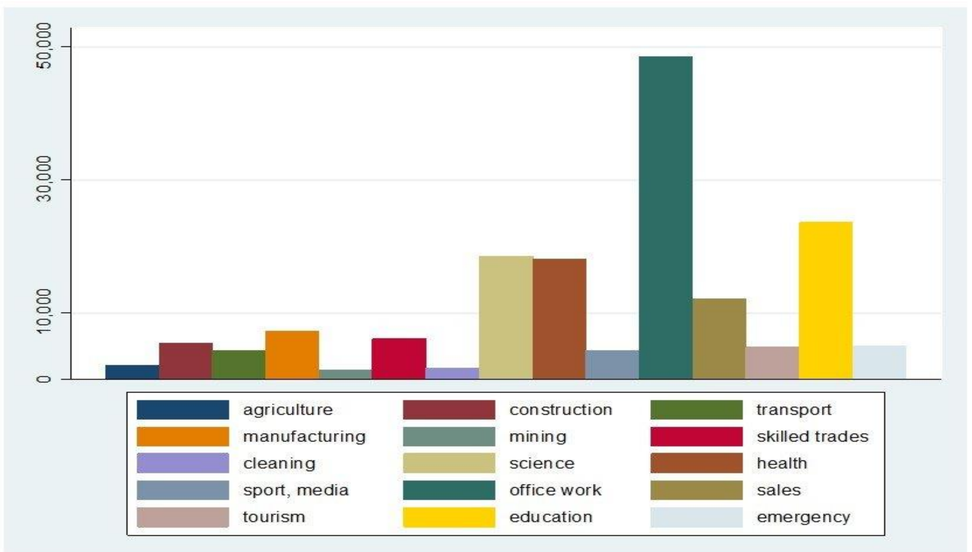
Methods:

- UK Biobank[4] is a multi-centre prospective population-based cohort of >500,000 people, aged 40-69 years, recruited in the UK in 2006-2010.
- COPD was spirometry-defined as FEV1/FVC<LLN (best ≥ two acceptable/repeatable curves according to ATS/ERS guidelines). OSCAR tool was administered to all UK Biobank participants with an available email address (n= 324,653) in Jun-Feb 2016. Paid jobs held ≥ six months were collected and coded by OSCAR using the UK Standard Occupational Classification (SOC) 2000.[5]
- Prevalence ratios (PRs) and 95% confidence intervals (CIs) of COPD for each SOC-coded job were estimated using a robust Poisson model[6] adjusted for sex, age, study centre and detailed lifetime tobacco smoking. In addition, we used lifetime cumulative job durations to test for exposure-response trends. Sensitivity analyses restricted to never smokers and non-asthmatics were performed to rule out any residual confounding.

Results:

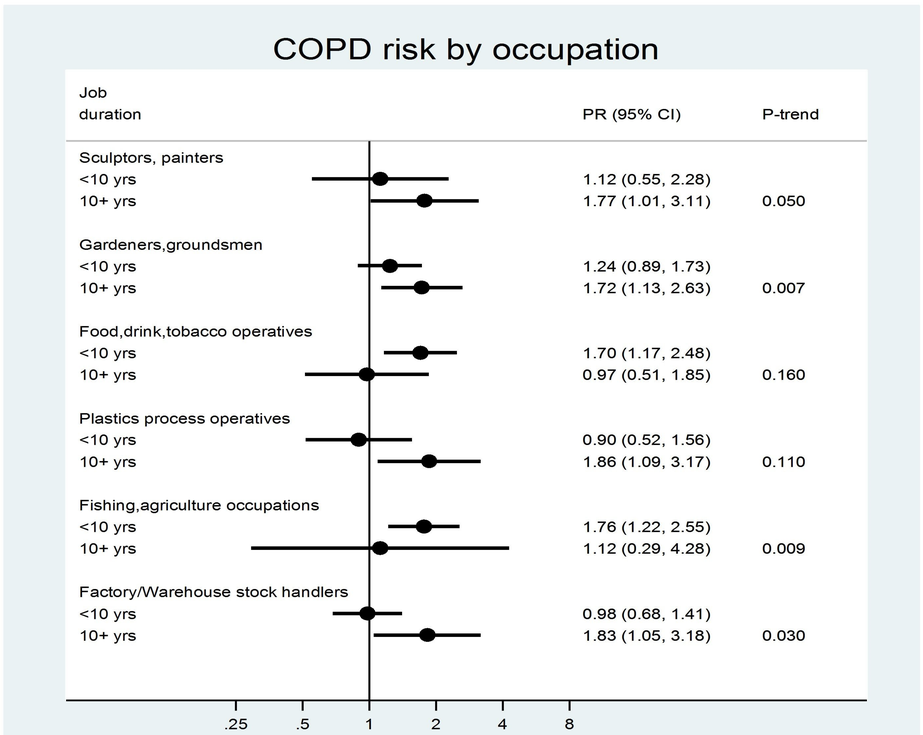
- Among the 116,375 OSCAR responders (34% response rate), 94,551 had acceptable/repeatable spirometry and smoking information and were included in the analyses. About 56% were women; the average age was 56 years in both genders. The majority were lifetime non-smokers (n= 55,596; 59%), only a minority were current smokers (6%) in both genders.
- The overall prevalence of COPD was 8% (7,606 cases), similar in both genders. The prevalence of COPD was higher among current smokers (17%) compared to ex- (9%) and never smokers (7%).
- The SOC-coded lifetime job-histories covered the period 1949-2016. Each individual reported up to 40 jobs with a median of 3 jobs. Using OSCAR major job-grouping categories as proxy for industry sectors, the most reported jobs were office-based (n=48,570; 51% of total jobs) and the least were in the mining sector (n=1,445; 1.5%) (**Figure1**). Gender-differences within job sectors were present: men dominated the mining sector, and women the cleaning sector (data not shown). Those who always reported only office-based jobs (n=19,286; 20% study sample) were used as reference category in all the analyses.

Figure 1. Distribution of SOC-coded jobs collected by OSCAR among the UK Biobank participants by industry sector



- To take advantage of the collected lifetime job-histories, we estimated COPD risks for 10-years categories of cumulative exposure within each SOC-coded job to test for exposure-response trends.
- Among the eight occupations found associated with increased COPD risk, and with borderline/significant linear exposure-response trends among all subjects, **six** were confirmed when we restricted the analyses to both never smokers (n=55,595) and never asthmatics (n= 84,034) (**Figure 2**).

Figure 2. COPD risk for 10-years categories of cumulative exposure to each SOC-coded job in the UK Biobank study (n= 94,551)



Prevalence Ratios (PRs) and 95% confidence intervals (95%CIs) for categories of cumulative exposure (years) to each SOC-coded job and COPD risk (defined as FEV_1/FVC<LLN) were calculated by using a Poisson model with robust variance adjusted for sex, study centre (22 categories), age (5-years categories), and lifetime smoking exposure (ever, pack-years, and years since quitting). Reference category: lifetime office workers.

Discussion and Conclusions:

- In the UK Biobank cohort six occupations were associated with increased COPD risk with borderline/significant trends for 10-years of cumulative exposure, also confirmed among never-smokers and never-asthmatics: 'Sculptors, painters', 'Gardeners, groundsmen'; 'Food, drink, and tobacco process operatives', 'Plastics process operatives', 'Fishing, agriculture related occupations', and 'Factory/Warehouse stock handlers'.
- Compared to our previous cross-sectional analyses, the majority of the job sectors were confirmed, such as the Manufacturing, and Fishing sectors. Interestingly, using the longitudinal lifetime job-histories, we found an increased COPD risk for the 'Agriculture sector' that we previously missed (this sector is one of the few a priori at high COPD risk) likely due to a 'healthy worker survivor effect' bias. New jobs emerged at COPD risk, such 'Sculptors, painters', and 'Plastics process operatives', that would deserve further attention.
- Strengths of these analyses are the population-based design, the large sample size that allowed subgroup analyses among never smokers and never asthmatics, the spirometry definition of COPD, and standard occupational coding (blind to COPD status). Limits, are the low response rate to OSCAR among the UK Biobank participants, likely responsible for underrepresentation of a few known COPD high-risk jobs (e.g. coal miners).
- All job sectors found associated with COPD risk entail potential exposure to respiratory occupational hazards, so we are planning to evaluate the underlying causal agents using the job-exposure matrix (ACE-JEM)[7] recently developed for this project in order to focus workplace preventive strategies where more needed.

References

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