Application of a dynamic population-based model to assess the effect of silica exposure interventions on COPD in Dutch construction workers: results from the 'Relieved Working Study

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Introduction

A multidimensional intervention study was performed to reduce personal quartz exposure in the Dutch construction industry (poster #0399). The intervention study focused on increasing the use of technical control measures (properly) among three high risk occupations by targeting organizational and behavioral factors The objective of this study was to assess the effect of the achieved reduction in exposure on the burden of chronic obstructive pulmonary disease (COPD) in these occupational groups.

MATERIALS AND METHODS

A dynamic population-based model for the development and progression of COPD (based on GOLD criteria) via changes in FEV1 and FVC was developed by the HSE (Figure 1). The simulation started in 1961 with a cohort of 20 year old males, resulting in a population with a stable age distribution in 2015. Every simulated year FEV1 and FVC were updated as described in Figure 1. Model inputs were based on various data sources including literature and (Dutch) occupational health databases. COPD prevalence estimates were projected under current exposure levels and when exposure was reduced to post-intervention levels from 2014 onwards for three job titles (i.e. concrete drillers, demolishers and tuck pointers: poster #0399).

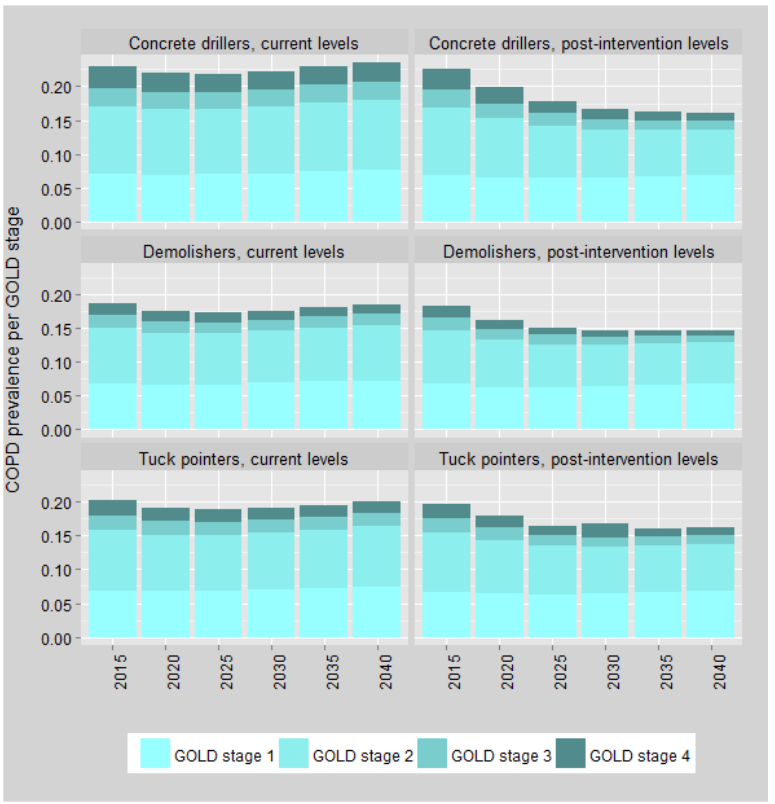

***Figure 2 Results: P**rojection of COPD prevalence per GOLD stage for Dutch concrete drillers, demolishers and tuck pointers under current (0.20, 0.13 and 0.16 mg/m³ quartz, respectively) and post-intervention (0.10, 0.05 and 0.05 mg/m3 quartz, respectively) exposure levels.*

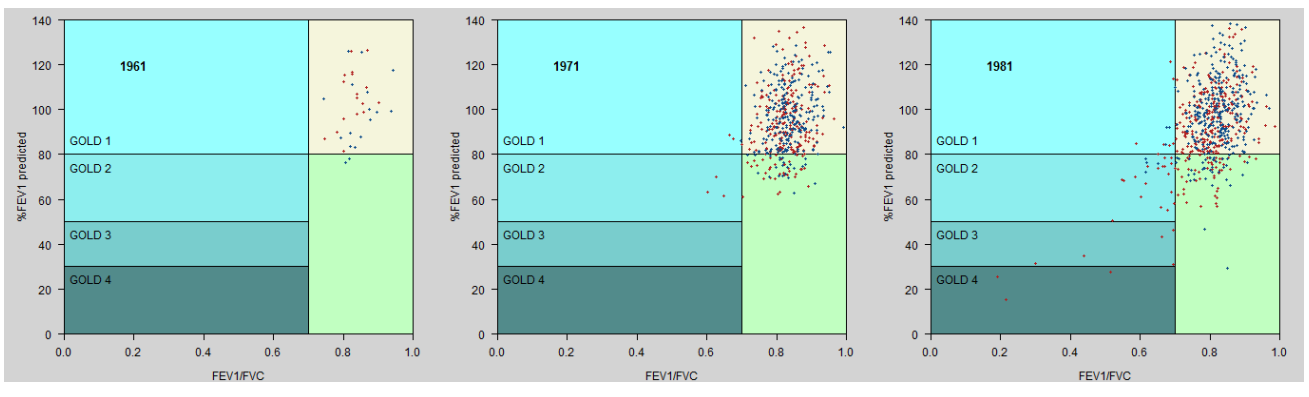

***Figure 1 Illustration of the simulation model:** The simulation starts in a given year with an initial population of a certain age. For every subsequent simulation years a new cohort is added, while the existing cohort ages one year and lung function (i.e. FEV1 and FVC) is updated by applying annual declines based on age, smoking status and occupational exposure. The model can be used to evaluate the effect of changes in e.g. smoking trends, age distribution, occupational exposure concentrations, etc. This example shows high (red) versus low (blue) exposure to silica.*

RESULTS

Preliminary analyses demonstrate a substantial reduction in COPD prevalence as a result of the intervention (Figure 2). In The Netherlands approximately 135.000 workers were employed in the construction industry in 2012, among whom we estimated around 2600 concrete drillers, 1000 demolishers and 2300 tuck pointers. Assuming constant population size, smoking characteristics and exposure levels at current conditions, approximately 1300 cases of COPD among these three job titles in 2040 are predicted. The burden of disease could be reduced by approximately 320 if the intervention effect would be accomplished and maintained among all of these workers.

CONCLUSIONS

This model can be used to estimate the effect of different exposure scenarios on the future burden of COPD. This model will be validated using surveys among Dutch construction workers. Ultimately the model will be applied to assess several intervention scenarios in all relevant job titles in the Netherlands.

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