



THE SELECTED ABSTRACTS

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205 A dynamic population-based model for the development of chronic obstructive pulmonary disease

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Abstract

Objectives

We present a mathematical model for the development of chronic obstructive pulmonary disease (COPD), incorporating population dynamics, trends in smoking, and occupational exposure to respirable dust, fumes and gases. The model simulates a population of workers longitudinally throughout their lifetimes and allows us to study the combined effects of smoking and exposure on the development and progression of COPD.

Methods

The model comprises: a population model, describing the attributes and dynamics of the population; a smoking model, representing demographic and individual trends in smoking; an exposure component, characterising inter- and intra-individual variation and temporal trends in occupational exposures; and a disease component, describing changes in FEV1, FVC, symptoms and exacerbations. Lung function parameters associated with a "healthy" population were estimated from international health surveys. Annual mean excess declines in FEV1 relating to smoking and occupational exposure to several agents, including coal dust and silica, were sourced from literature. Inter-individual variation in declines encapsulates susceptibility of individuals, some of whom will experience especially deleterious effects of smoking and exposure.

Sensitivity analysis provides information on the most influential parameters and uncertainties associated with the model.

Results

A preliminary simulation without occupational exposure predicted a current prevalence of >10% in males of working age, consistent with a recent Health Survey for England study, and a modest decline over the next 30 years due to recent trends in smoking participation rates. Using coal dust as a surrogate for poorly soluble dusts, the model confirms that reduction in long-term exposure decreases an individual's risk of developing COPD, with the greatest impact in non-smokers.

Conclusions

The model provides us with valuable information on current and future trends in COPD in Britain. It may be used to assess the effects of reducing levels of exposure or of introducing health surveillance.

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