

# Air pollution and chronic bronchitis: the evidence firms up

Frank Kelly 

Chronic bronchitis is defined epidemiologically as cough and sputum production for  $\geq 3$  months in each of at least two consecutive years.<sup>1</sup> It affects about a third of patients with chronic obstructive pulmonary disease but also occurs in individuals with normal lung function, with prevalence estimates varying widely.<sup>2–7</sup> While it is not, by itself, associated with a substantially higher risk of death,<sup>8</sup> it is associated with exacerbations of disease, incapacity and poor quality of life. The identification of chronic bronchitis was standardised in the first instance by the British Medical Research Council questionnaire,<sup>9</sup> and subsequently, the questions were introduced into other respiratory symptom questionnaires.

Ambient air pollution is increasingly being linked to a range of human conditions, and in the case of chronic bronchitis, which affects over two million individuals in the UK,<sup>10</sup> there is some evidence of an association between the incidence or prevalence of chronic bronchitis and long-term exposure to air pollution.<sup>11–13</sup> Early reports, however, relate to a time when the bulk of outdoor air pollution came from coal burning when pollutant levels were considerably higher than they are today. Of interest, a real-world study by Holland and Reid showed higher rates of cough and phlegm and lower lung function in London postal workers where pollution levels were much higher than in the three county towns where comparative postal workers were recruited.<sup>14</sup>

In 2016, the Committee on the Medical Effects of air Pollutants identified 36 studies that examined a possible link between air pollution (primarily particulate matter (PM) pollution) and chronic bronchitis.<sup>15</sup> Some of the longitudinal studies in Europe and USA that were included in this report demonstrated changes in symptoms following a reduction in the concentration of air

pollution.<sup>16–18</sup> However, the overall body of evidence of associations between chronic bronchitis and long-term exposure to air pollution was inconsistent, and more detailed and well-controlled epidemiological studies were recommended.<sup>15</sup> Rising to this challenge, Doiron and colleagues in this issue of *Thorax* report findings from the largest analysis to date to examine cross-sectional and longitudinal associations between ambient air pollution and chronic bronchitis.<sup>19</sup>

In their carefully controlled study, using the Dutch Lifetimes cohort data on 132 595 (baseline) and 65 009 (second assessment) participants, they assessed possible associations of air pollution with prevalence and incidence of chronic bronchitis (winter cough and sputum almost daily for  $\geq 3$  months/year), chronic cough (winter cough almost daily for  $\geq 3$  months/year) and prevalence of cough and sputum symptoms. Logistic regression models were deployed to adjust for sex, age, educational attainment, body mass index, smoking status, pack-years smoking and environmental tobacco smoke at home. Whereas the majority of previous studies focused on exposure to particulate pollution alone, Doiron *et al* used land use regression model exposure estimates from the ELAPSE study for PM with a diameter of less than 2.5  $\mu\text{m}$ , and nitrogen dioxide ( $\text{NO}_2$ )<sup>20</sup> and black carbon (BC) from the ESCAPE study.<sup>21</sup>

In the north of the Netherlands,  $\text{NO}_2$  and BC concentrations were found to be associated with increased odds of prevalent and incident chronic bronchitis. Of note, higher effect sizes were seen among women, never smokers and younger individuals supporting earlier findings for women in the European Community Respiratory Health Survey, where  $\text{NO}_2$  was associated with the prevalence and new onset of chronic phlegm and chronic productive cough.<sup>22</sup> This finding also aligns with Gundersen *et al*, who found a large excess of cough and phlegm associated with moderate and high levels of exposure to traffic among women, which in this study was particularly marked among smokers and not found among men.<sup>23</sup>

Given this is the largest study to date examining the relationship between relatively low ambient air pollution exposures and chronic bronchitis, it contributes to an urgent need for research into the link between air pollution and this chronic condition. Furthermore, in relation to the impact on health, the 2005 report of the cost-benefit analyses for the Clean Air for Europe programme estimated (in monetary valuation) that chronic bronchitis was, after adult mortality, the next most important health outcome in relation to long-term exposure to air pollution.<sup>24</sup> The findings reported by Doiron and colleagues set the scene for further work to estimate economic costs of this disease attributable to ambient air pollution, which, given its prevalence, are likely to be sizeable.

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