Committee on the Medical Effects of Air Pollutants

Quantification of the Effects of Air Pollutants on Health in the UK.

Interim Statement. 18th January 2006

1 A subgroup of the Committee on the Medical Effects of Air Pollutants (COMEAP) is currently preparing a report which will, as far as possible, quantify the benefits to health of reducing air pollution in the UK. COMEAP has advised on quantification in earlier reports[1,2]. The sub-group considered a draft of the first part of our report on the 20th December 2005, concerning the effects on mortality of long-term exposure to air pollutants, especially ambient particles. We agreed that the draft was sufficiently advanced and that our views were sufficiently developed to allow us to produce this interim statement. We understand that this is needed by DEFRA for use in their review of the Air Quality Strategy. We intend to publish a detailed report on the effects on health of long-term exposure to air pollutants later in 2006. This later report will include consideration of the effects of gaseous pollutants in addition to those of particles and of effects on morbidity in addition to those on mortality.

2 We have agreed that the evidence base that links long-term exposure to particles and mortality has been strengthened since our last report on this topic published in 2001[1]. It is our considered view that the associations reported in the literature of this field are likely to represent causal relationships with air pollution, especially particles, although we accept that there is a small possibility that some or all of the reported associations represent the effects of some as yet unidentified confounding factor or factors. We have examined the evidence regarding associations between long-term exposure to particles and increased risks of mortality. Our confidence in that evidence is such that we have been able to identify and agree a coefficient for use in quantifying the benefits to health of a reduction in ambient particle concentrations in the UK.

3 We also have agreed that careful expression of the value of this coefficient is needed. This will be reported in terms of our uncertainty regarding the value of the coefficient. While we have investigated many of the specific areas of uncertainty in detail, and that has enabled us to form interim conclusions about them, we have not yet completed our work on summarising and representing our overall uncertainty about the chosen coefficient. Thus the conclusion reported here must be regarded as an interim conclusion with regard to the assessment of uncertainty.

4 We have agreed that the American Cancer Society (ACS) study provides the single best source of information for quantifying the effects on mortality of long-term exposure to air pollution and that, from the ACS study, particulate matter measured as $PM_{2.5}$ is the most appropriate measure of air pollution for use in quantification. In saying this we point out that the identity of the individual components of the ambient aerosol that affect health remain unknown and thus we regard $PM_{2.5}$ as an index of

a certain type of air pollution mixture. From the epidemiological evidence available, we consider that it is not possible to distinguish with confidence between the effects of the different components of the mixture, nor of different sources. In the absence of clear evidence to the contrary, therefore, we consider that the coefficient should apply equally to all components of $PM_{2.5}$, including sulphate.

5 We have discussed the case for adjusting coefficients linking $PM_{2.5}$ and mortality for a variety of factors including sulphur dioxide, spatial auto-correlation and measurement error. We have also discussed the case for taking into account the higher coefficients found in studies at smaller spatial scales. We noted that some factors tend to decrease the coefficient whereas other factors tend to increase it. We concluded that we would not attempt to formally adjust the relevant ACS coefficients as published, to take account of the joint effect of these factors. Instead, we intend to reflect our discussions in an expression of uncertainty regarding the exact value of our preferred coefficient. Details of our discussions will be provided in our final report.

6 In defining a coefficient linking $PM_{2.5}$ and mortality and advising on its use for quantification we agreed the following points:

(i) $PM_{2.5}$ is our chosen index of pollution
(ii) The coefficient will be expressed, as is conventional, as the percentage change in relative risk of death per 10μg/m^3 change in annual average $PM_{2.5}$
(iii) Calculations should focus on the benefits likely to be delivered by changes in $PM_{2.5}$ rather than on estimating the total impact on health of current $PM_{2.5}$. We accept that the latter can be calculated from our interim conclusions but we wish to consider, further, the uncertainties associated with such a calculation.
(iv) The effects chosen for quantification are all-cause, cardio-respiratory mortality and lung cancer mortality. We present, here, a coefficient relating to all cause mortality; coefficients relating to all cause, cardiorespiratory and lung cancer mortality will be included in our final report.
(v) We recognise the need to define the "cessation lag" i.e. the time from reductions in $PM_{2.5}$ to the consequent reductions in risks of mortality. This is needed for calculations using the life-table methodology reported elsewhere[3]. Although the evidence is limited, our judgement tends towards a greater proportion of the effect occurring in the years soon after pollution reduction rather than later. We intend to discuss this further in our final report.

7 We have chosen the coefficient based on the averaged exposure period reported by Pope *et al*[4] as our best, current, estimate of that linking $PM_{2.5}$ and all-cause mortality in the UK. This coefficient is based on the largest available cohort study. In addition, the methodology of this study has been exposed to searching re-examination by the US Health Effects Institute[5]. The results of the ACS cohort are buttressed by those of the small number

of other cohort studies published to date. We believe the coefficient can be transferred to the UK. There are uncertainties involved, but these could operate in either direction.

8 As noted, we have not completed our work on the expression of uncertainty and for the moment report the coefficient with only the 95% Confidence Intervals (95% CI) as provided by Pope *et al*[4]. We do not consider this to be satisfactory, for two reasons. First, it represents only the statistical (sampling) uncertainty associated with the coefficient, whereas, in addition, we wish to reflect uncertainty regarding adjustment of the coefficient for the factors noted above and with regard to its transferability to the UK. Second, and operating in the other direction, 95% confidence intervals may suggest a greater uncertainty than we intend: we consider it more likely that the true coefficient lies close to the centre than close to the boundaries of the 95% interval. We will explore these points in more detail in our further work on uncertainty.

9 Our interim conclusion is, then, that the effects on mortality of long term exposure to a mixture of air pollutants, represented by $PM_{2.5}$, are best characterised by the following coefficient, expressed in terms of the percentage change in Relative Risk of all-cause mortality per 10µg/m^3 change in annual average $PM_{2.5}$:

1.06 (95% CI: 1.02 – 1.11).

10 We note that this represents a change from that provided in our last report. This reflects the expansion of the evidence-base in this area and our deeper understanding of the effects of pollutants, and other factors, on health.

REFERENCES

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