CORRESPONDENCE

Update of the Texaco mortality study 1947–93: part II

EDITOR—It is with a sense of “deja-vu” that I read the paper by Divine et al on the update of the Texaco mortality study. I was particularly struck by their conclusions about lung cancer among the maintenance trades. Although large numbers of mesotheliomas were found among these workers, the authors concluded that there was no increased risk of lung cancer because the SMRs were <100. This conclusion is similar to that of Tsai et al who, despite the findings of excess mortality from mesothelioma and increased lung cancer mortality among maintenance workers, in comparison with operators at another Texas refinery, concluded that asbestos exposures were "not sufficient to produce lung cancer". It is also similar to that of Raabe et al who stated that, although they had found an increase in lung cancer mortality among maintenance craft workers, the "temporal patterns of these SMRs and findings from other studies of similar cohorts provided evidence that the excesses were most likely to be related to work in maintenance craft jobs".

Workers in the petroleum refinery industry, when grouped together, have had a lower risk of lung cancer than members of the general population. This has been found once again in the paper by Divine et al. Given this phenomenon, it is appropriate to make internal comparisons—that is, to compare the lung cancer experience of maintenance workers exposed to asbestos with that of operators with minimal or no exposure to asbestos. When this is done, the risk of lung cancer is indeed increased among maintenance workers in the refinery and petrochemical sector.

I have performed some calculations with the data in the table of Divine et al, and I find that in their study there is a significant trend in risk of lung cancer with duration of employment in the maintenance trades. The table below shows the data. I have subtracted the experience of the maintenance employees from that of the total cohort to produce the SMR for unexposed workers. The SMR for lung cancer increases with the duration of time employed in the maintenance trades. I used equation number (3.12) in the monograph of Breslow and Day to compute a test for trend in these SMRs. I used the integers 1 to 4 to rank the exposure levels. The value for χ² in the trend test was 10.2 on 1 degree of freedom (p<0.001). I thus conclude that the study of Divine et al contributes yet another piece of evidence showing that workers exposed to asbestos in the refinery and petrochemical sector are at increased risk of lung cancer.

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Author’s reply—Finkelstein has reviewed the lung cancer results for a select group of maintenance workers in our paper on the update of the Texaco mortality study. In his letter, he suggests that although several papers on petroleum refinery workers have not seen an increase in the standardised mortality ratios (SMR) for lung cancer, if internal comparisons of the SMRs were done, this would show an increased risk of lung cancer among maintenance workers in the refinery and petrochemical sector.

It has been well documented that a valid comparison of group mortality rates within the Texaco refinery requires that the underlying age specific mortality rate within each study group is constant or that the age distributions of person-years for the subgroups from the complete Texaco mortality study 1947–73 are similar. However, it should be emphasised that the observed numbers of deaths from lung cancer are still less than expected for each of the maintenance employee groups. Even for the group of maintenance workers potentially exposed >20 years, there is still an 11% deficit of lung cancer (SMR 89, 95% confidence interval (95% CI) 70 to 112).

It should be noted that the maintenance category that Finkelstein has constructed is a combination of all of the different maintenance trades, except for insulators, each with different job responsibilities and exposures. If the trends for lung cancer for the maintenance subgroups from the complete Texaco mortality study report are examined (unpublished data), none of these categories show an increasing trend in the lung cancer SMR with increasing duration of employment in the subgroup (as shown in table 1).

However, in a previous article, Finkelstein again compared the results for lung cancer in maintenance workers who had >20 years of potential exposure to asbestos to those for non-maintenance employees who had ≥20 years of employment in refinery or chemical operations. Because age was related to cumulative exposure, the mortality rates for workers with ≥20 years of potential exposure to asbestos was older than the corresponding non-maintenance group. In fact, 52% of the person-years in the maintenance group was from workers ≥60 years but only 20% in the non-maintenance group. Although Finkelstein calculated a relative risk, based on the ratio of two SMRs, 1.24 for the two groups, a more exact age standardised rate ratio for lung cancer is 1.09 (95% CI 0.79 to 1.50) (Tsai SP, Gilsstrap EL, Ross CE. Lung cancer among maintenance employees in a refinery and petrochemical plant, unpublished letter). This rate ratio does not support increased lung cancer mortality among maintenance employees when compared with non-maintenance employees.

Also, in their study of maintenance workers potentially exposed to asbestos, Tsai et al provided similar SMRs for lung cancer by duration of employment for maintenance workers (a group defined exactly as in our report). The SMRs are 88, 77, and 83 for those employed 1–4 years, 5–19 years, and ≥20 years as maintenance workers, and there is no trend of increasing lung cancer with increasing duration of employment. Thus, the study of Tsai et al does not support Finkelstein’s allegations that, in general, petroleum industry maintenance workers have an increased risk of lung cancer compared with other workers, which increases with duration of employment as a maintenance worker.

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Table 1 Lung cancer mortality by duration of employment in specific maintenance crafts

<table>
<thead>
<tr>
<th>Specific craft</th>
<th>Total</th>
<th>0–4 y</th>
<th>5–19 y</th>
<th>≥20 y</th>
<th>Trend test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obs</td>
<td>(95% CI)</td>
<td>Obs</td>
<td>(95% CI)</td>
<td>Obs</td>
</tr>
<tr>
<td>Insulator</td>
<td>48</td>
<td>(90 to 120)</td>
<td>31</td>
<td>(52 to 110)</td>
<td>10</td>
</tr>
<tr>
<td>Painter</td>
<td>30</td>
<td>(76 to 108)</td>
<td>19</td>
<td>(69 to 108)</td>
<td>8</td>
</tr>
<tr>
<td>Structural steel, pipe fitter, machinist</td>
<td>202</td>
<td>(78 to 107)</td>
<td>105</td>
<td>(80 to 97)</td>
<td>46</td>
</tr>
<tr>
<td>Electrician, instrument</td>
<td>35</td>
<td>(78 to 108)</td>
<td>11</td>
<td>(89 to 160)</td>
<td>19</td>
</tr>
<tr>
<td>Boilermaker, welder, lead burner</td>
<td>52</td>
<td>(65 to 85)</td>
<td>23</td>
<td>(60 to 90)</td>
<td>19</td>
</tr>
<tr>
<td>Equipment operator</td>
<td>59</td>
<td>(73 to 95)</td>
<td>42</td>
<td>(76 to 103)</td>
<td>9</td>
</tr>
<tr>
<td>Cleaner</td>
<td>91</td>
<td>(68 to 134)</td>
<td>94</td>
<td>(67 to 103)</td>
<td>5</td>
</tr>
<tr>
<td>Pipefitter, boilermaker</td>
<td>161</td>
<td>(81 to 104)</td>
<td>97</td>
<td>(73 to 95)</td>
<td>33</td>
</tr>
<tr>
<td>All maintenance</td>
<td>419</td>
<td>(74 to 81)</td>
<td>213</td>
<td>(76 to 86)</td>
<td>99</td>
</tr>
</tbody>
</table>
Recent attention. Leukaemia has been the subject of much research. To date, however, no specific agents or mechanisms have been identified. In this connection, it may be worth recalling that those who did the classic work on feline leukaemia virus stressed that nothing about the pattern of the usual (sporadic) cases of leukaemia in domestic urban cats suggested infection; only in the special situation of multicat households did the disease show epidemic features.

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Childhood leukaemia, population mixing, and paternal occupation

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