

# Occupation and cancer in London: an investigation into nasal and bladder cancer using the Cancer Atlas

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**ABSTRACT** The *Atlas of Cancer Mortality for England and Wales* showed pronounced excesses of male mortality from nasal and bladder cancer in certain London boroughs. These excesses were investigated by case-referent studies using death certificate data for male deaths, 1968-78. Nasal cancer was found to be significantly associated with occupations involving heavy exposure to wood dust. Bladder cancer was significantly associated with occupations in road transport driving and in the handling of leather, whereas consistently raised relative risk ratios were also found for woodworkers, engineering fitters, printers, machinists, plumbers, and motor mechanics. These findings highlight the potential role of occupational factors in cancer causation in London.

For centuries London has been the chief manufacturing centre of Great Britain,<sup>1</sup> a fact obscured by the diversity and wide distribution of industries that have been located there, even to the present day. During the nineteenth century, the abundance of cheap, unskilled, immigrant labour led to the expansion of industry in the East End, where the appalling social and working conditions became favourite targets for the great Victorian reformers.<sup>2</sup> Between the two world wars, development in west London gave rise there to the most important concentration of manufacturing industry in southern England.<sup>1</sup> These and other industrial concentrations exist today, despite their recent pronounced contraction and the rise in importance of service industries. A new opportunity to consider the impact of occupational factors on the capital's health has arisen with the publication of the *Atlas of Cancer Mortality for England and Wales*.<sup>3</sup> This atlas and previous work in its preparation<sup>4</sup> have shown pronounced excesses of mortality from pleural mesothelioma and nasal and bladder cancer for men in different parts of the country, including certain London boroughs, between 1968 and 1978. The excess of mesothelioma in London has been attributed to past usage of asbestos in the docks and east London factories.<sup>5,6</sup> Causal factors for nasal and bladder cancer in London are not so well described, though previous work has pointed to nasal cancer being

linked to furniture manufacture,<sup>7,8</sup> a suggestion we study further in this paper. We report here case-control studies using death certificate information for the same years covered by the atlas to explore further the role of local occupational factors in the causation of nasal and bladder cancer in those London boroughs with the highest mortality from these diseases.

## Materials and methods

### NASAL CANCER

Of the 33 London boroughs, those shown by the atlas as having the highest statistically significant ( $p < 0.05$ ) standardised mortality ratios (SMRs) for men from nasal cancer were Camden (SMR = 220), Hackney (SMR = 201), and Tower Hamlets (SMR = 267). The next highest SMR was for Islington (SMR = 178) which, though just failing to attain statistical significance, was included in the analysis because, like the other three boroughs, it was well known for its high concentration of woodworking industries (fig 1). All deaths to male residents in these boroughs from 1968 to 1978 inclusive, in which the underlying cause of death was certified as cancer of the nose, nasal cavities, middle ear-accessory sinuses (ICD No 160), were included, and two controls were chosen for each of these 54 cases. The first control was randomly selected from male deaths from all other cancers, matching London Borough of residence, year of death, and age to within plus or minus five years. The second was randomly selected from male

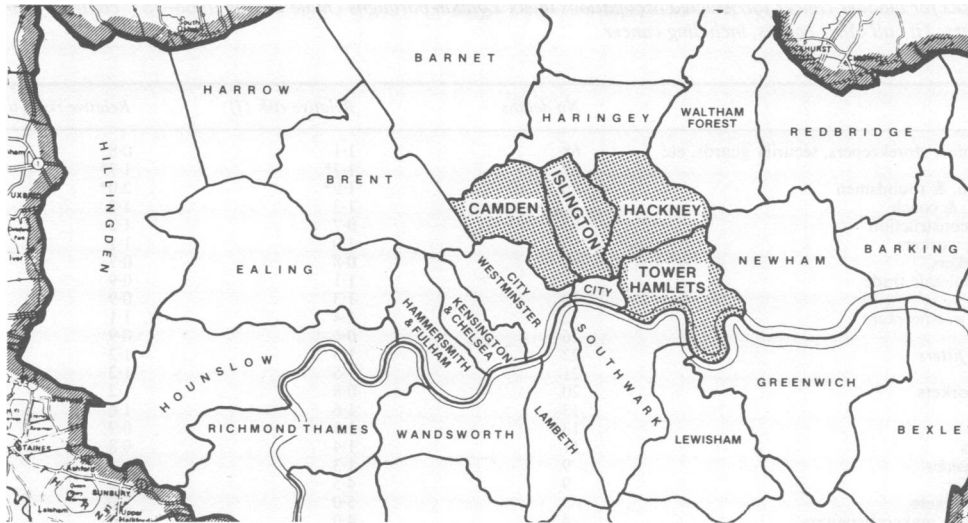


Fig 1 London boroughs with the highest mortality from nasal cancer (male deaths, 1968-78).

deaths from all causes (including cancers, except nasal cancer), matching for boroughs and age as for the first group. Death entries for cases and controls were extracted and the occupational information abstracted by one of us (MM).

**BLADDER CANCER**

Eleven boroughs had statistically significant raised SMRs for bladder cancer in men. Six of these were highly significant ( $p < 0.01$ ) and were chosen on this basis for study (fig 2): Hillingdon (SMR = 127), Kensington and Chelsea (SMR = 134), Lambeth (SMR

= 124), Lewisham (SMR = 124), Southwark (SMR = 135) and Tower Hamlets (SMR = 134). With the exception of Hillingdon these boroughs are all centrally located. The cases chosen were all deaths from 1968 to 1978 inclusive to male residents of these six boroughs in which the underlying cause of death was certified as cancer of the bladder (ICD 188). Two controls for each of the 1080 cases were chosen using the same procedure as for the study into nasal cancer.

An association between bladder cancer and cigarette smoking has been clearly established,<sup>9</sup> and it is pertinent to consider whether this should affect the

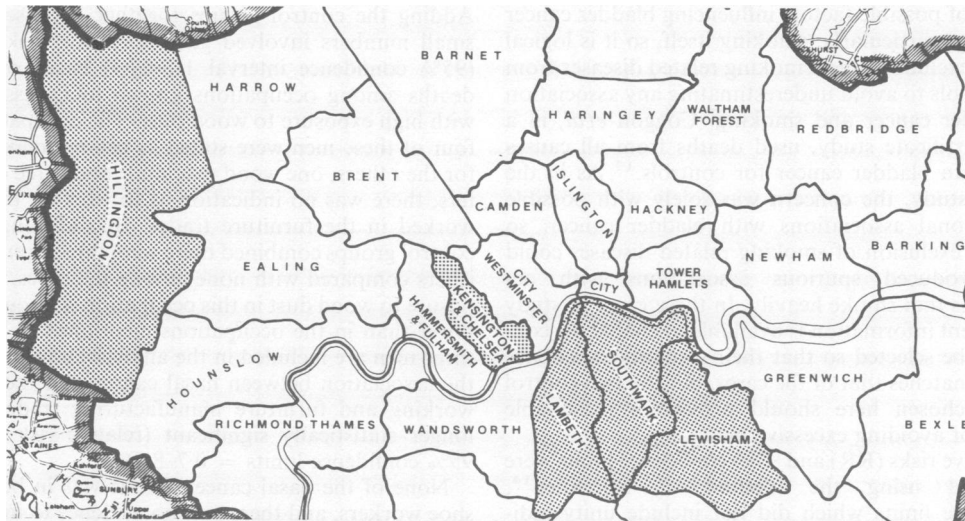


Fig 2 London boroughs with the highest mortality from bladder cancer (male deaths, 1968-78).

Relative risks for bladder cancer for selected occupations in six London boroughs (male deaths, 1968-78): controls from (i) all other cancers; (ii) all other causes, including cancer

Occupation	No deaths	Relative risk (i)	Relative risk (ii)
Warehousemen, storekeepers, security guards, etc	68	1.1	0.8
Drivers:	67	1.7*	1.7*
Lorry, van, & roundsmen	46	1.9*	2.0*
Taxi, bus, & coach	21	1.3	1.2
Building & construction	61	0.7	1.2
Engineering workers	54	1.0	1.1
Clerical workers	48	0.8	0.7
Retail & wholesale trade	41	1.1	0.9
Labourers	39	1.3	0.9
Carpenters, woodworkers	32	1.4	1.1
Dockers	26	0.6	0.9
Engineering fitters	22	1.3	1.2
Printers	21	1.5	1.2
Electrical workers	20	0.8	1.2
Plumbers	13	1.6	1.6
Tailors	13	1.3	0.9
Gas workers	11	1.4	0.8
Motor mechanics	9	1.3	1.1
Leather trades:	9	4.5	4.5
Leather workers	5	5.0	5.0
Boot & shoe makers/repairers	4	4.0	4.0
Hairdressers	4	†	2.0
Furriers	3	3.0	†
Rubber workers	2	0.7	†
Cable makers	1	2.0	1.0
Doctors, nurses	1	0.2	0.5
Dye workers	0	†	—

\*Statistically significant at 95% confidence level.

†No controls in this occupation.

choice of controls in a study in which direct smoking data are not available. Three case-control studies of bladder cancer that have studied occupation have excluded people suffering from tobacco related disease.<sup>10-12</sup> Nevertheless, these studies have looked at a range of possible factors influencing bladder cancer including, particularly, smoking itself, so it is logical to have excluded other smoking related diseases from the controls to avoid underestimating any association of bladder cancer and smoking. Coggon *et al*, in a death certificate study, used deaths from all causes other than bladder cancer for controls.<sup>13</sup> As in the present study, the concern was solely with possible occupational associations with bladder cancer, so that the exclusion of smoking related diseases could have produced spurious associations with occupations that smoke heavily. In these types of study insufficient information is available to enable the controls to be selected so that their smoking experience exactly matches that of the cases, but the two control groups chosen here should provide a reasonable chance of avoiding excessive bias.

Relative risks (RR) and 95% confidence limits were calculated using the method of Miettinen<sup>14</sup>; confidence limits which did not include unity indicated that the relative risk was significant ( $p < 0.05$ ).

## Results

### NASAL CANCER

The only occupational category with a significantly increased risk for nasal cancer was woodworking. Adding the control groups together because of the small numbers involved gave a relative risk of 4.5 (95% confidence interval 1.2-17.1) based on eight deaths among occupations known to be associated with high exposure to wood dust. The occupations of four of these men were stated as cabinet makers but for the others, one wood machinist and three carpenters, there was no indication as to whether they had worked in the furniture trades. In addition, in the control groups combined there were three French polishers compared with none among the cases, but exposure to wood dust in this occupation is known to be lower than in the occupations mentioned.<sup>15</sup> If these three men are included in the analysis, however, then the association between nasal cancer and the wood-working and furniture manufacturing trades is no longer statistically significant (relative risk = 2.5, 95% confidence limits = 0.7-8.8).

None of the nasal cancer deaths was in boot and shoe workers, and there was no evidence to implicate other dusty trades, including clothing manufacture.

## BLADDER CANCER

The table shows the numbers of deaths and their relative risks against each control group for selected occupations. The most striking results are the consistently raised relative risks for all road transport drivers (RR = 1.7 and 1.7) including lorry drivers, van drivers, and roundsmen (RR = 2.0 and 1.9), which were all significant at the 95% confidence level.

The relative risks for the following occupations were also consistently raised for both control groups, but were not statistically significant, even when both control groups were combined: woodworkers and carpenters (RR = 1.1, 1.4); engineering fitters (RR = 1.2, 1.3); printers (RR = 1.2, 1.5); machine operators (RR = 1.4, 1.6); plumbers (RR = 1.6, 1.6); motor mechanics (RR = 1.1, 1.3); leather workers (RR = 5.0, 5.0), and boot and shoe makers and repairers (RR = 4.0, 4.0).

Boot and shoe makers and repairers, and leather workers, have in common the handling of leather. Combining the two groups of workers and comparing with their combined controls gives a RR of 4.5, which is statistically significant (95% confidence limits: 1.4-15.1). No cases were found for dye workers, and the findings for rubber workers and cable makers and gas workers were unremarkable.

## Discussion

Death from occupational cancer may take place several decades after the initial causal exposures, and it is therefore necessary to consider the pattern of London's industries<sup>1</sup> at least 20 years before the beginning of the study period. Victorian London contained three great manufacturing industries: clothing, furniture, and footwear. By 1951 clothing trades remained of national importance in terms of absolute size and had been joined by electrical engineering. Compared with the rest of the country, furniture manufacturing in London had retained a relatively high concentration of workers, as had printing, together with the manufacture of precision instruments and paint. The footwear industry had largely decayed, but leather goods (today much diminished) were important. Service industries such as insurance, banking, and finance (located in and around the City area), and transport had grown substantially. Industries manufacturing metals, chemicals (including dyes), and textiles have never been of any size.

The finding of an association between nasal cancer and woodworking trades in London was not unexpected, being consistent with previous observations in furniture makers<sup>4,7,8</sup>, even today, high exposures to wood dust may be observed in numerous small workplaces. We found no evidence, however, of an association for clothing workers as had been suggested,<sup>16</sup>

despite the high concentration of "rag trades" in the East End. Other industries located in London and which have been suggested at risk, but for which no association with nasal cancer was found, include printing<sup>16</sup> and chromate manufacture.<sup>17</sup> Small scale manufacture of chromate pigments and their usage in the paint industry has been longstanding.

Bladder cancer is known to be caused by exposure to certain aromatic amines in the dye, rubber, and coal gas industries in the past. Unlike dye manufacture, rubber and cable making factories were numerous in London before 1949, the year when rubber antioxidants containing the potent bladder carcinogen 2-naphthylamine were withdrawn,<sup>18</sup> though a national census of such factories in 1967 suggested that these antioxidants were handled in only a few firms in the particular boroughs we have studied<sup>19</sup> (Health and Safety Executive, unpublished observations). Davies *et al* reported that, over ten years up to the end of 1975, about 5% of men with bladder cancer attending the Royal Marsden Hospital, a major London cancer centre partly located in the borough of Kensington and Chelsea but drawing its patients from a much wider area, had a history elicited at interview of exposure to bladder carcinogens in the rubber and cable making or coal gas industries.<sup>20</sup> Surprisingly, perhaps, excesses were not identified in these industries in the present study. On the other hand, our results agree with several other previously observed occupational associations—namely, wood workers<sup>21,22</sup> engineering fitters,<sup>23</sup> printers,<sup>24-26</sup> machinists,<sup>21,27</sup> plumbers,<sup>21</sup> mechanics,<sup>27</sup> and leather workers, including boot and shoe makers and repairers.<sup>12,28,29</sup> The handling of leather may entail exposure to carcinogenic chemicals.<sup>30</sup> The British fur trade, though now much diminished, survives today mainly in London's East End where it is still possible to observe traditional methods of fur treatment, including the routine use of numerous chemical dyes. A suggested association between clerical work and mortality from bladder cancer<sup>28,31</sup> is not supported by our study.

The most striking result, however, was the excess bladder cancer mortality of road transport drivers, with the highest relative risks (2.0 and 1.9) for lorry and van drivers. It is of considerable interest that a similar finding has recently emerged in a study of bladder cancer in Detroit,<sup>32</sup> which was also an attempt to explain high local death rates shown by cancer mapping, and is supported by at least four previous studies.<sup>26,27,33,34</sup> The percentage of the male workforce employed in driving in the six boroughs studied, however, has been only marginally greater than that for England and Wales (4.8% and 6% respectively of economically active men in the 1971 Census<sup>35</sup>). The mortality excess in the drivers may

not, therefore, contribute much to the overall excess mortality from bladder cancer, unless the association is unique to drivers in these boroughs, which seems unlikely in view of the studies noted above. Although the excess of deaths from bladder cancer in these boroughs which, with the exception of Hillingdon, are centrally located may not be explained by the occupational risks we have found, it may, however, be linked to some general environmental factor(s). One possible clue is provided by the study in Detroit<sup>32</sup> mentioned above, in that the cancer hazard for drivers was considered to be diesel exhaust fumes; the overall relative risk for truck drivers of 2.1 rose to 11.9 when drivers exposed to diesel fume only were considered. Living in the inner boroughs of a vast city may certainly result in considerable exposure to diesel and petrol exhaust fumes as well as raised concentrations of other harmful air pollutants.<sup>36</sup> Indeed, the usage of diesel vehicles in London appears to have been remarkably constant since 1950 (Greater London Council, unpublished observations), though there has been a dramatic improvement in overall air quality so far as smoke and SO<sub>2</sub> pollutants are concerned since the disastrous smog in 1952.<sup>36</sup> The possibility that the air of major inner cities contains pollutants that may interact with other agents in the causation of bladder cancer therefore merits further consideration. Other non-occupational factors have been implicated in the aetiology of bladder cancer and may have also acted as confounding variables in the present study, notably cigarette smoking<sup>31</sup>; other suggested factors have included coffee drinking<sup>37</sup> and the taking of artificial sweeteners.<sup>38</sup> The precise aetiological factors in these London boroughs can be identified only by further studies.

We have used the occupation recorded on the death certificate to investigate further clues provided by the Cancer Atlas. Our case-control method has the advantages of relative simplicity and cheapness, but it is evident that it suffers from lack of sensitivity in that only the last occupation of the deceased is usually recorded and that may be misleading. Undoubtedly, problems inherent in cancer mapping in general, such as leaving London and the fact that the place of residence may be far from work, should not be underestimated in London either. Since the second world war companies have been encouraged to move out and many Londoners commute long distances to work. Despite these major drawbacks our results are encouraging in that they are in accord with those from several previous studies and have also shown a significant excess of bladder cancer among one of the largest occupational groups, road transport drivers, though this excess per se is unlikely to explain the overall high incidence of bladder cancer in the boroughs. It is more tempting to assign most, if not all, of

the excess of the nasal cancer detected by the atlas to the concentration of former woodworkers in the boroughs studied because of the known strong association of this tumour with furniture manufacture, but it is impossible to be certain of this on the basis of our study alone. Detailed epidemiological studies that include life time occupational histories are clearly necessary to follow up the leads we have found. Most of London's workplaces have fewer than 250 employees (Her Majesty's Factory Inspectorate, unpublished observations), however, and few firms of this size in Britain have any occupational health services or adequate records of occupational diseases,<sup>39</sup> with the result that the true extent of occupational cancer is not known.

Nevertheless, the results presented here seem sufficiently promising to commend our method as a useful tool for following up leads to cancer mapping and serve to highlight the potential role of occupational factors in the causation of cancer in London.

We thank Dr Martin Gardner for his encouragement and Dr David Ball and Mr Peter Munt, Scientific Services Branch, Greater London Council, for information on diesel vehicles in London.

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