

Adenocarcinoma of the nasal cavity and sinuses in England and Wales

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Acheson, E. D., Cowdell, R. H., and Rang, Elizabeth (1972). *Brit. J. industr. Med.*, **29**, 21-30. **Adenocarcinoma of the nasal cavity and sinuses in England and Wales.** A survey of nasal adenocarcinoma in England and Wales (excluding the Oxford region) is described. Where possible, occupational details were obtained and the histological material on the basis of which the diagnosis had been made was reassessed. A total of 107 patients with adenocarcinoma (80 men and 27 women) and 110 matched control cases of nasal cancer of other histological types (85 men and 25 women) were accepted for analysis. The material was classified according to occupation and the distribution compared with that of the population of England and Wales in 1961. Thirty-four of the adenocarcinoma patients (including one woman) and nine patients in the control group had at some stage of their career worked with wood—the majority in the furniture industry. In addition to providing abundant further evidence of the association between nasal adenocarcinoma and work in the furniture industry the evidence suggests that a smaller but nevertheless material risk of developing other histological types of nasal cancer may exist for workers in the industry. It is probable that certain woodworkers outside the furniture industry are also at risk although the risk is almost certainly very much less than in the furniture industry. An excess of nasal cancer patients who had been leather workers (usually in the boot and shoe making and repairing industries) was also found.

Adenocarcinoma of the nasal cavity is a rare tumour. In cancer registers in southern England in which information about the histological classification of tumours is available, adenocarcinomas account for about 8% of all epithelial malignant tumours of the nasal cavity and accessory sinuses. The average annual incidence in persons over 15 years of age in southern England is 0.8 per million in men and 0.4 in women (Acheson, Cowdell, and Jolles, 1970a).

A national survey of adenocarcinoma of the nasal cavity was prompted by the need to see whether the increased risk of this tumour which had been demonstrated in the Buckinghamshire and Oxfordshire furniture industry extended to furniture workers in other parts of the country. It was hoped that the possibility that other occupational groups might be affected could be examined at the same time.

Material and method

A letter was written to each of the cancer registries in England, with the exception of the Oxford Regional Register, asking for particulars of all adenocarcinomas of the nasal cavity and sinuses registered in recent years. The Oxford Region was excluded from the study as it had already been the subject of a detailed analysis published elsewhere. In the event, not all registries were able to comply with the request as in some areas no record of the histological type of the tumour is kept. Fortunately these registries were able to respond by supplying data about *all* registered nasal cancers. Histological material was then sought directly from the hospitals concerned. Most registries provided material covering the years 1961-6, but a few were able to cover a longer span of years.

As a second stage, registries were asked to supply particulars of a control case for each of the adenocarcinomas. The controls were to be patients with nasal cancer

of a histological type other than adenocarcinoma, of the same sex and within five years of age, registered in the same region and in the same year.

For all cases and controls an attempt was made to obtain a full occupational history. In all but two cases permission to approach the patient or his relatives was obtained, either from the family doctor or from the specialist concerned with the hospital treatment. A letter was then written to the patient or his relatives explaining that an investigation was being made into occupational factors in various diseases of the nose and asking for a simple questionnaire to be completed.

Results

Table 1 shows the numbers of nasal adenocarcinomas and of control cases ascertained according to the amount of occupational and pathological information available.

A total of 145 nasal adenocarcinomas and 133 controls was ascertained. Slides were obtained and examined by one of us (R.H.C.) in 107 (73.8%) of the adenocarcinomas and in 98 (73.7%) of the controls. The histological classification of adenocarcinoma was not confirmed in 33 (22.8%) of the cases submitted as such, and these have been discarded from the analysis. Among the controls for which slides were available, four cases were reclassified as adenocarcinomas and have been added to the series of adenocarcinomas. Cases ascertained as adenocarcinomas in which it has not been possible to examine sections have been retained.

Table 1 also shows the material classified according to the amount of occupational data received. In 89 (61.4%) of the cases and in 85 (63.9%) of the controls the patient or a relative was contacted and information was received in answer to a questionnaire or by correspondence. In a further 38 (26.2%) of the cases and 29 (21.8%) of the controls, in whom it was not possible to contact the patient or relatives, a small amount of occupational data was obtained either from the hospital records or from the death certificate.

Table 2 shows in summary form the number of cases and controls accepted and rejected for each sex separately. As might be expected, occupational data were lacking in a higher proportion of the women than of the men.

Histological classification

In Table 3 the 205 cases for which histological material was available for examination are shown according to the original classification and also as reclassified by R.H.C. In considering this Table it is important to remember that it does not represent a rigorous comparison of the interpretation of a series of histological slides by pairs of observers. Many of the differences arise from the fact that the original classification given is often based on the diagnostic grouping used in cancer registries. These frequently do not subdivide tumours of certain sites in the degree of detail used by pathologists so that, for example, adenocarcinomas of minor salivary glands and cylindromas of the nose may be placed in the general category of adenocarcinoma of the nose although they are distinct in both histology and behaviour. Where the pathologist's diagnosis was obtainable, discrepancies were rare and tended to relate to such distinctions as between anaplastic carcinoma and malignant melanoma which do not affect the present argument to any great extent. In our earlier work, the excess of adenocarcinomas in woodworkers stood out unequivocally before statistical study and, to avoid any bias in this direction, we did not include as adenocarcinoma any tumour so necrotic or poorly differentiated as to leave any room for doubt. Most of the adenocarcinomas are remarkably uniform in type, being fairly well differentiated with a papillary columnar-cell pattern (Fig. 1), often with plentiful mucus secretion and sometimes with extensive mucoid degeneration (Fig. 2). They invade bone early and several cases have presented initially with meningitis secondary to intracranial spread.

TABLE 1
ADENOCARCINOMAS AND CONTROLS ACCORDING TO HISTOLOGICAL CLASSIFICATION AND AMOUNT OF OCCUPATIONAL DATA RECEIVED (PERCENTAGES IN PARENTHESES)

Histological classification	Adenocarcinomas Occupation				Controls Occupation			
	History obtained	Incomplete data	No data	Total	History obtained	Incomplete data	No data	Total
Confirmed	59 (40.7)	12 (8.3)	3 (2.1)	74 (51.0)	66 (49.6)	13 (9.8)	15 (11.3)	94 (70.7)
Not confirmed	14 (9.7)	10 (6.9)	9 (6.2)	33 (22.8)	3 (2.3)	1 (0.7)	—	4 (3.0)
Slides not obtained	16 (11.0)	16 (11.0)	6 (4.1)	38 (26.2)	16 (12.0)	15 (11.3)	4 (3.0)	35 (26.3)
Total	89 (61.4)	38 (26.2)	18 (12.4)	145 (100.0)	85 (63.9)	29 (21.8)	19 (14.3)	133 (100.0)

TABLE 2

NUMBERS (PERCENTAGES IN PARENTHESES) OF ADENOCARCINOMAS AND CONTROLS ACCEPTED, AND NUMBERS REJECTED, GIVING REASON, FOR EACH SEX SEPARATELY

	<i>Adenocarcinomas</i>		<i>Controls</i>	
	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Females</i>
Accepted				
Histology confirmed	59 (57.3)	16 (34.9)	57 (60.6)	22 (62.9)
Slides not obtained	21 (20.4)	11 (23.9)	28 (29.8)	3 (8.5)
	<hr/> 80 (77.7)	<hr/> 27 (58.8)	<hr/> 85 (90.4)	<hr/> 25 (71.4)
Rejected				
Histological grounds	17 (16.5)	7 (15.2)	—	—
No occupational data	3 (2.9)	6 (13.0)	9 (9.6)	10 (28.6)
On both grounds	3 (2.9)	6 (13.0)	—	—
	<hr/> 23 (22.3)	<hr/> 19 (41.2)	<hr/> 9 (9.6)	<hr/> 10 (28.6)
Total	103 (100.0)	46 (100.0)	94 (100.0)	35 (100.0)

The 4 control cases reclassified as adenocarcinomas have been shown as adenocarcinomas.

TABLE 3

HISTOLOGICAL COMPARISON OF THE SLIDES WHICH WERE EXAMINED

<i>Initial classification</i>	<i>R.H.C.'s classification</i>									<i>Total</i>
	<i>Adenoca.</i>	<i>Transi- tional</i>	<i>Squamous</i>	<i>Anaplastic</i>	<i>Melanoma</i>	<i>Plasma- cytoma</i>	<i>Cylindroma</i>	<i>Salivary adenoca.</i>	<i>Other</i>	
Adenocarcinomas ..	74	2	5	7	0	0	0	9	1	107
Controls										
Transitional	0	3	2	1	0	0	0	0	0	6
Squamous	2	4	50	1	0	0	1	0	0	58
Anaplastic	2	1	5	2	0	1	1	1	0	13
Other	0	0	0	0	1	0	0	1	0	2
Totals	78	10	62	11	1	1	11	11	1	186
Not specified	0	3	9	1	4	1	0	1	0	19

Occupational distribution

Table 4 shows, for men only, the adenocarcinoma cases and the controls classified according to the Registrar General's Classification of Occupations into Orders (1960). Two alternative definitions of occupation are given. The first is based on the occupation of the patient at the time the tumour was diagnosed or, for men who had retired, the last occupation followed. The second is based on the occupation followed for the longest period of time during the man's career. The results of these two classifications are seen to be closely similar. The expected distribution of the cases has been calculated by simple proportion from the distribution of economically active and retired males by occupation at the 1961 census (General Register Office, 1961). Material

for the Oxford Region is included in the 1961 census figures from which the expected numbers have been calculated but is excluded from the observed number of cancer cases. The effect of this discrepancy is to increase marginally the expected numbers of woodworkers and leatherworkers and therefore to reduce the contrast between observed and expected.

When the distribution of the adenocarcinoma cases is compared with the expected distribution, the excess of patients with adenocarcinoma who were woodworkers stands out as the most striking feature and, statistically speaking, is highly significant ($\chi^2 = 319$, $n = 1$, $P < 0.001$). When the woodworkers are divided into those known to have worked mainly in the furniture industry and the



FIG. 1. Papillary mucus-secreting nasal adenocarcinoma. (Haematoxylin and eosin, $\times 90$)

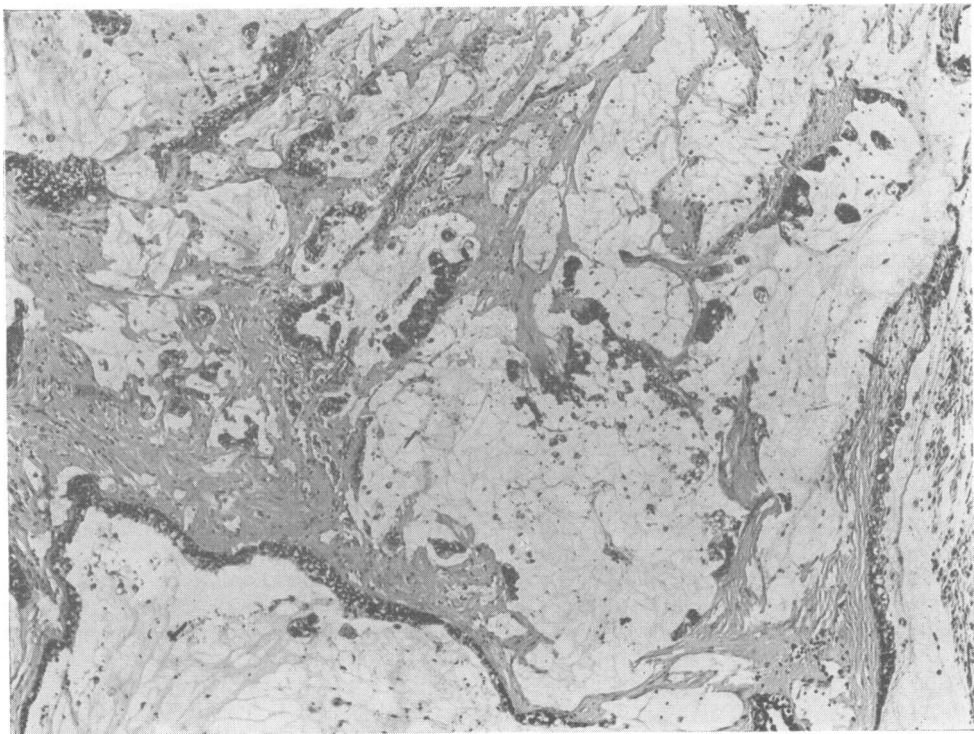


FIG. 2. Mucoid degeneration in same tumour as in Figure 1. (Haematoxylin and eosin, $\times 90$)

TABLE 4

CASES AND CONTROLS, INCLUDING RETIRED PERSONS, DISTRIBUTED BY OCCUPATIONAL ORDER (MALES ONLY)

Occupational order		Adenocarcinomas			Controls	
		At diagnosis or on retirement ¹	Main occupation ¹	Expected numbers	At diagnosis or on retirement	Main occupation
I	Farmers, foresters, and fishermen ..	3	2	4.2	6	6
II	Miners and quarrymen	3	3	2.7	4	4
III	Gas, coke, and chemicals makers ..	1	2	0.6	2	2
IV	Glass and ceramics makers	1	1	0.3	0	0
V	Furnace, forge, etc. workers	3	3	1.3	0	1
VI	Electrical and electronic workers ..	1	1	2.2	2	1
VII	Engineers and allied trade workers ..	5	5	11.2	9	9
VIII	Woodworkers	24	28	2.1	8	9
	Furniture industry ²	15	19	0.2	4	5
	Others and unspecified	9	9	1.9	4	4
IX	Leather workers	7	7	0.5	1	1
X	Textile workers	2	2	0.8	2	2
XI	Clothing workers	2	2	0.5	0	0
XII	Food, drink, and tobacco workers ..	1	1	1.4	1	1
XIII	Paper and printing workers	0	0	1.1	1	1
XIV	Makers of other products	0	0	0.9	1	1
XV	Construction workers	1	1	2.7	4	4
XVI	Painters and decorators	1	1	1.6	2	2
XVII	Drivers of cranes, etc.	0	0	1.5	1	1
XVIII	Labourers, n.e.c.	3	3	6.1	5	5
XIX	Transport and communication workers ..	1	1	6.7	12	12
XX	Warehousemen, etc.	2	0	2.6	2	2
XXI	Clerical workers	2	2	5.7	2	2
XXII	Sales workers	3	2	6.3	6	6
XXIII	Service, sport, and n.e.c. workers ..	6	5	4.1	6	5
XXIV	Administrators and managers	2	2	3.1	1	1
XXV	Professional technical workers	4	4	6.0	6	7
XXVI	Armed forces	0	0	1.5	1	0
XXVII	Inadequately described	2	2	2.2	0	0
	Total	80	80	80	85	85

¹The cases are shown by occupation (a) at diagnosis or on retirement and (b) main occupation.

²It has been assumed that all the persons enumerated at the census in occupational category 081, and about half those in category 082, were working in the furniture industry.

remainder (principally carpenters and joiners), we find that the ratio of observed to expected cases is much higher among the furniture workers (95 to 1) than among the others (5 to 1). The excess risk in furniture workers would appear even greater if two cases in carpenters who worked for a short time in the industry, and one case in a wood machinist and one in a woodworker, the nature of whose work is uncertain, were classified with them. Of the other occupational orders, only the leather workers (order IX) have an unequivocal excess of adenocarcinoma cases ($\chi^2 = 84$, $n = 1$, $P < 0.001$).

The distribution of the control nasal cancer cases is much closer to the expected distribution. It is worth noting, however, that there is also a significant excess of nasal cancers other than adenocarcinomas among woodworkers ($\chi^2 = 23$, $n = 1$, $P < 0.001$). In this group the greater relative risk once again appears to be among the furniture

workers. Such an excess is not surprising since a proportion of the anaplastic carcinomas may be presumed to be of glandular origin, and squamous metaplasia in the nose is a common phenomenon. The significance of the twofold excess of transport and communication workers (order XIX) is doubtful. The majority of these cases occurred among road vehicle drivers (occupations 195, 196, and 197) but these occupations constitute together more than half the population of this order.

Occupational data for the female adenocarcinoma cases and for their controls is less adequate than for the men. This stems from the unfortunate tendency on hospital records and on death certificates to classify women in terms of their husband's occupation. Another contributing factor may be that elderly deceased female patients less frequently have living relatives who can give an occupational history than have the deceased males. For these

reasons, 12 of the 46 (26.1%) female adenocarcinoma cases and 10 of 35 (28.6%) controls had no occupational data available. Of those for whom there were occupational data a greater proportion of the adenocarcinomas (24 out of 34—70.6%) than of the controls (12 out of 25—48.0%) had spent much or most of their lives employed outside the home. However, the difference between these two proportions is not significant ($\chi^2 = 2.2$, $P < 0.10$ where $n = 1$).

Due to the small numbers involved and the problems of classification, not much can be deduced from the distribution by occupation of the female adenocarcinoma cases and controls. Of the 24 women with adenocarcinoma who were classified as having been 'economically active' for much of their lives, one was a wood stainer and one an upholsterer who had also worked in the glove trade (cases 427 and 531). Five of the adenocarcinoma cases (one expected) and two of the controls (0.5 expected) had worked for long periods in the textile industry. With these exceptions the distributions were roughly as expected.

In Table 5 historical details are listed for all patients for whom we have information that they engaged at any time in woodwork or in one of the leather trades. Historical details of persons who worked in the textile and clothing industry are shown in Table 6.

Table 5a consists of 29 workers (of whom 28 are male and one female) who at some time are known to have worked in the furniture industry. Twenty-five of these workers suffered from adenocarcinoma, three from squamous tumours, and one from a transitional-cell tumour. Nine of them did not appear in Table 4 as woodworkers because their main occupation or their occupation at diagnosis or on retirement was classified in one of the other orders. Two others (cases 416 and 417) were classified as carpenters and joiners. Of the 29 subjects, 13 had been cabinet or chairmakers, nine were wood machinists, turners or sawyers, three were woodworkers of unspecified craft, two were upholsterers, one was a wood stainer, and one was a French polisher.

Table 5b consists of eight male woodworkers for whom we have detailed occupational information, and for whom there is no evidence that they ever worked in the furniture industry; six had adenocarcinomas and two had squamous tumours. Six additional cases (Table 5c) are shown in whom it is uncertain whether or not they worked in the furniture industry.

Table 5d shows particulars of 12 persons, of whom 10 are men and two women, who at some time worked in one of the leather trades, eight with adenocarcinoma and four with squamous tumours. Once again, those who do not appear as leather workers

in Table 4, because their principal occupation and their occupation at the time the tumour was diagnosed or on retirement was in a different field, or because they are female, are indicated by asterisks.

Workers in the textile industry The analysis of the tumours in female subjects of the survey according to main occupation suggested that there might be an excess of textile workers with adenocarcinoma and possibly other types of tumour. Although the numbers are very small, the distribution of cases and controls in males by occupation (Table 4) supports this suggestion. A search was therefore made within the survey for persons who had spent short periods in the textile industry in addition to the seven women already referred to and the four men in Table 4 whose principal occupation, or occupation at diagnosis or on retirement, had been in the textile industry. Six additional cases were found, three with adenocarcinomas and three with other tumours (excluding the two upholsterers who also had had contact with wood dust and the upholsterer (case 531) who had worked in the Yeovil glove trade) to add to the 11 textile workers already known. In addition, three adenocarcinoma cases were found in patients who had been exposed to the dust of textiles in the clothing industry (cases 445, 476, and 518). The occupational details of all 20 cases are shown in Table 6. Nine of the adenocarcinoma cases and five of the controls had been exposed to cotton dust either in the spinning or weaving processes or in the clothing trade. Four adenocarcinoma cases and two controls had been exposed to the dusts of other textiles including wool (4), fur and felt (1), and linen (1). The dressmaker (case 476) was exposed to the dust of various types of material including cotton but the actual amount of dust was small.

Discussion

This study provides additional evidence of the relationship between work in the furniture industry and the development of nasal adenocarcinoma. This relationship was first demonstrated in a detailed survey of nasal cancer in Oxfordshire, Buckinghamshire, and Berkshire (Acheson, Cowdell, Hadfield, and Macbeth, 1968). Subsequently case reports have been published from Belgium (Debois, 1969), France (Gignoux and Bernard, 1969), and Denmark (Mosbech and Acheson, 1971). In Britain, nasal adenocarcinoma in the furniture-making industry is now a prescribed industrial disease, and the study reported here confirms that a risk of nasal adenocarcinoma exists throughout the British furniture industry and is not limited to the Oxford Region.

The strong suggestion from Table 4 that there is also an increased risk of histological types of tumour

TABLE 5
(b) WOODWORKERS NOT IN THE FURNITURE INDUSTRY

Case	Sex	Year of Birth Entry to industry		Nature of industry	Occupation in industry	Year left industry	District where employed	Year of diagnosis	Histology	Principal types of dust to which exposed	Site of tumour	Other work
403	M	1909	1922	Building contractor	Joiner	Un-known	Blackburn	1966	Adeno	Soft woods	L. nasal cavity	
404	M	1890	1904		Builder	Joiner and carpenter	1965	Macclesfield	1965	Adeno		
411	M	1904	1919	Builder	Joiner	1962	London	1962	Adeno	Unknown	L. ethmoids	Smallholder
412	M	1910	1925	Builder	Joiner	Un-known	Stockport	1964	Adeno	Soft woods	Ethmoids	
424	M	1901	1917	Own business	Wheelwright, carpenter, undertaker	1960	Norfolk	1964	Adeno	Unknown	Max. antrum	
425	M	1901	1919	Timber yard	Sawyer	1964	Norfolk	1965	Adeno	Unknown	Ethmoids	Timber merchant
511	M	1879	1901	Packing firm	Packing case maker	1955	London	1964	Squamous	Soft woods	Nasal cavity	
514	M	1919	(1923)	Builder	Carpenter	Un-known	London	1967	Squamous	Unknown	Max. antrum	

(c) WOODWORKERS WHERE LITTLE OCCUPATIONAL DETAIL IS KNOWN

Case	Sex	Year of Birth Entry to industry		Nature of industry	Occupation in industry	Year left industry	District where employed	Year of diagnosis	Histology	Principal types of dust to which exposed	Site of tumour	Other work
413	M	Un-known	Un-known	Unknown	Carpenter and joiner	Un-known	Birmingham	1964	Adeno	Unknown	L. nose	
415	M	1892	"		"	Wood machinist	"	Birmingham	1963	Adeno	"	Ethmoids
417	M	1914	"	"	Wood worker	"	Newcastle	1969	Adeno	"	Ethmoids	
533	M	1902	"	"	Labourer in carpenter's shop	"	Birmingham	1963	Squamous	"	Nostril	
534	M	1884	"	"	Carpenter	"	Sheffield	1961	Malignant polyp	"	Nasal	
535	M	1899	"	"	Carpenter	"	Leeds	Un-known	Transitional papillomatosis	"	Unknown	

(d) LEATHERWORKERS¹

Case	Sex	Year of Birth Entry to industry		Nature of industry	Occupation in industry	Year left industry	District where employed	Year of diagnosis	Histology	Principal types of dust to which exposed	Site of tumour	Other work
441	M	1873	1887	Boot repair shop	Leather cutter	1945	Newcastle	1961	Adeno	Leather	Unknown	Manager of public house Miner ¹
442	M	1907	1921	Shoe repair shop	Shoe repairer	1934	Birmingham	1962	Adeno	Leather	Unknown	
494	M	1902	1919	Footwear, retailer, and repairer	Supervision of workshop for repair		London	1964	Adeno	Leather and rubber	Antrum	
502	M	1907	(1922)	Leather goods retailer and repairer	Shoe repairer		Gloucester	1964	Adeno	Leather and rubber	Antro-ethmoid	
505	M	1879	1895	Shoe factory	Shoe factory worker		Bristol	1962	Adeno	Leather	Ethmoids	
450	M	1914	1928	Shoe factory	Shoemaker	1968	Newcastle	1965	Adeno	Leather	Ethmoids	
506	M	1908	1922	Shoe repair shop	Shoe repairer	1967	Weston-super-Mare	1965	Adeno	Leather and rubber	Nasal cavity	
516	M	1907	1922	Shoe factory	Finisher until 1927; later cleaned floors and dust extractor plant		Norwich	1967	Squamous	Leather and rubber	Max. antrum	
517	M	1896	1910	Boot and shoe factory	Boot and shoe operative	1914	Norwich	1964	Squamous	Leather and rubber	Max. antrum	'Bus driver' ¹
515	M	1910	1924	Boot and shoe factory	Shoe maker		Somerset	1964	Squamous	Leather	Max. antrum	Hospital orderly Cleaner of offices ¹
530	F	1891	1914	Home	Handbag maker	1918	Manchester	1961	Squamous	Unknown	Unknown	
531	F	1908	1923		1923-4 Yeovil glove trade; 1929-45 Upholstery		Somerset	1964	Adeno		Unknown	

¹Details of all these cases except 502 (1091) have been published in a previous paper (Acheson, Cowdell, and Jolles, 1970a).

TABLE 5
(a) WORKERS IN THE FURNITURE INDUSTRY

Case	Sex	Year of Birth	Entry to industry	Nature of industry	Occupation in industry	Year left industry	District where employed	Year of diagnosis	Histology	Principal types of dust to which exposed	Site of tumour	Other work
401	M	1905	(1919)	Furniture maker	Cabinet maker	1951	London	1964	Adeno	Unknown	Ethmoids	GPO as telephonist Storeman in TV factory Making scientific instruments ¹
402	M	1908	1915	Own business	Wood turner	1955	London	1964	Adeno	Unknown	Ethmoids	
405	M	1900	1919	Radio cabinets	Cabinet maker	1940	Essex	1961	Adeno	Mahogany, oak, beech	Nasal cavity	
406	M	1888	1903	Not known	Wood worker and machinist	1952	Birmingham	1959	Adeno	Unknown	Ethmoids	
407	M	1895	1906	Furniture manufact.; undertakers	Spindle moulder	1959	Essex	1959	Adeno	Oak, mahogany, walnut, birch, elm	Unknown	
408	M	1917	1933	Church furniture; aircraft parts	Wood worker	1948	Leeds	1965	Adeno	Oak, spruce, birch	Nasal cavity	Farmer ¹
409	M	1895	1909	Furniture manufact.	Wood machinist	1940	Preston, Lancs	1961	Adeno	Oak, mahogany, beech	Ethmoids	Commercial traveller
410	M	1906	1920	Furniture manufact.	Wood turner	1964	Ipswich	1964	Adeno	Oak, walnut, beech, ash, elm, birch	Ethmoids	
416	M	1903	1917	Furniture trade; shop-fitting	Cabinet maker Carpenter ²	1926 1968	Norwich	1967	Adeno	Oak, teak, deal, mahogany, walnut, alder, birch	Nasal cavity	
417	M	1916	1931	Furniture trade; building firms	Circular saw operator Joiner ²	1937 1945-67	Leeds	1964	Adeno	Unknown	Nasal cavity	
419	M	(1904)	1919	Furniture factory	Wood machinist	1966	Barnstaple	1964	Adeno	Oak, mahogany, walnut, beech	Unknown	
420	M	1905	(1919)	Furniture manufact.	Cabinet maker	1964	London	1964	Adeno	Unknown	Nasal cavity	
421	M	1903	(1917)	Not known	Cabinet maker	1961	Norwich	1961	Adeno	Unknown	Ethmoids	Demolition worker ¹ Instrument fitter
422	M	1904	1919	Furniture manufact.	Wood worker	1930	Norwich	1968	Adeno	Unknown	Ethmoids	
423	M	1907	1921	Furniture factory	Wood machinist	1942	Wellington, Salop	1959	Adeno	Unknown	Antrum	
426	M	1886	1900	Furniture manufact.	Wood machinist	1958	Salop Solihull, Warw.	1969	Adeno	Unknown	Unknown	
428	M	1904	(1918)	Furniture maker	Cabinet maker	1968 (Died)	Bromley	1968	Adeno	Mahogany, teak, iroka, oak	Maxillary antrum	
429	M	1911	1922	Furniture maker	Wood worker		Pontefract	1965	Adeno	Unknown	Nasal cavity	
430	M	1909	1923	Chair maker	Chair maker	1965 (Died)	London	1965	Adeno	Unknown	Unknown	
431	M	1918	1932	Furniture maker	Cabinet maker	1965 (Died)	London	1965	Adeno	Unknown	Antrum	
448	M	1890	1904	Furniture factory	Cabinet maker	1926	Worcester	1959	Adeno	Unknown	Nasal cavity	Licensee to death ¹
470	M	1909	1923	Furniture maker	Cabinet maker	1927	Plymouth	1964	Adeno	Unknown	Unknown	Building trade as labourer ¹
427	F	1903	Un-known	Furniture maker	Wood stainer	Un-known	Norwich	1965	Adeno	Unknown	Maxillary antrum	¹
473	M	1916	1930	Furniture maker	Upholsterer	1939	Bristol	1964	Adeno	Flock, fibre, horsehair, and wood dust	Unknown	Coach trimmer ¹
414	M	1912	1926	Furniture maker	Upholsterer		Liverpool	1967	Adeno	Fibre, coir flock, and wood dust	Unknown	¹
510	M	1909	1925	Shipyards	French polisher	1959	Newcastle	1959	Squamous	Unknown	Nasal cavity	¹
512	M	1907	Un-known	Furniture factory	Cabinet maker	Un-known	London	1959	Transitional	Unknown	Ethmoids	¹
513	M	1886	1899	Furniture factory (office)	Cabinet maker	1961	London	1964	Squamous	Unknown	Antrum	
532	M	1899	1915	Furniture factory	Cabinet maker	1956	Norwich	1961	Squamous	Unknown	Ethmoids	

¹On main occupational table not listed as woodworker.
²Noted as carpenter on main table.

continued

TABLE 6
WORKERS IN TEXTILE AND CLOTHING INDUSTRY

Case	Sex	Year of Birth	Year of Entry to industry	Nature of industry	Occupation in industry	Year left industry	District where employed	Year of diagnosis	Histology	Principal types of dust to which exposed	Site of tumour	Other work
439	F	1912	1927	Cotton factory	Winder and spinner	1962	Manchester	1961	Adeno	Cotton	Unknown	
480	F	1895	1909	Cotton factory	Card room assistant cotton reeler	1947	Manchester	1963	Adeno	Cotton	Ethmoid	
452	F	1888	1903	Cotton mill	Weaver	1948	Manchester	1963	Adeno	Cotton	Nasal cavity	
497	F	1894	1907	Cotton mill	Hank winder	1930	Manchester	1965	Adeno	Cotton	Nasal cavity	
482	F	1921	1935	Unknown	Making men's braces	1939	Manchester	1966	Adeno	Cotton	Antrum	Clerk
446	F	1910	1942	Worsted spinners	Milling machinist (also Hoffmann presser)	1943	Leeds	1964	Adeno	Wool (cloth dust)	Ethmoid	Hoffman press 1928-42
445	F	1905	(1919)	Millinery	Milliner	1925-1945-64	London	1967	Adeno	Fur, felt, straw	Ethmoid	
476	F	1898	Unknown	Unknown	Dressmaker	Unknown	London	1963	Adeno	Cotton and other material	Nasal cavity	Shopkeeper ¹
458	M	1886	1900	Cotton fabric industry	Office boy to company chairman	1965 (Died)	Manchester	1962	Adeno	Cotton	Nasal cavity	¹
432	M	1911	Unknown	Carpet manufact.	Carpet weaver	1967	Birmingham	1967	Adeno	Wool	Ethmoid	
528	M	1898	1920	Bleach works	Linen finisher	1956	Birmingham	1962	Adeno	Linen	Antrum	Cleaner
518	M	1893	1933	Sewing firm	Machine assistant	1938	Manchester	1964	Adeno	Cotton	Antrum	Garage prop. ¹
521	F	1910	1904	Cotton mill	Sorter, carder	1964	Manchester	1964	Adeno	Cotton	Unknown	
526	F	1903	1932	Worsted spinner	Winder, reeler, warper	1965	Leeds	1966	Squamous	Wool	Antrum	
525	F	1897	(1910)	Textile factory	Weaver	Unknown	Warwick	1966	Squamous	Cotton	Antrum	Laundry worker
523	F	1900	1914	Woollen mill	Weaver	1926	Manchester	1966	Melanoma	Wool	Unknown	
520	M	1921	1937	Cotton mill	Packer—winding room; mule spinner	1954	Manchester	1964	Histology uncertain; not adeno	Cotton	Unknown	
522	M	1913	1927	Cotton mill	Lad in packing room	1929	Manchester	1966	Histology uncertain; not adeno	Cotton	Unknown	Window cleaner ¹
519	M	1888	1902	Cotton mill	Cot packer	1921	Manchester	1963	Melanoma	Cotton	Unknown	
524	M	1903	1915	Cotton mill	Spinner	1932	Manchester	1966	Melanoma	Cotton	Unknown	Plater-de Havilland ¹

Male not listed as textile worker in Table 4.

other than adenocarcinoma in furniture workers will come as no surprise to pathologists. A reappraisal of the published material from the original survey from Oxford shows that four nasal tumours other than adenocarcinomas (2 transitional cell, 1 squamous, and 1 anaplastic) had arisen in Buckinghamshire furniture workers up to the end of 1967, two in males and two in females. It is extremely difficult to calculate a realistic 'expected' figure. Using generous assumptions, namely that the average annual risk of nasal cancer in the general population of both sexes is 10 per million and that the population of furniture workers at risk was 5,000, 0.5 cases would be expected over a decade. Of the 18 cases reported in Belgian woodworkers, two were squamous tumours and one was an undifferentiated

tumour (Debois, 1969). One of the 17 woodworkers reported by Gignoux and Bernard (1969) as suffering from nasal cancer had a reticulum-cell sarcoma.

There is also evidence in this paper that certain woodworkers outside the furniture industry may be at risk in respect of nasal cancer. Indeed, in view of the overlap which exists between the type of work carried out by carpenters and joiners, and cabinet makers and machinists, it would be surprising if this were not so. Table 5b lists eight patients in whom there is sufficient occupational data to be virtually certain that they never worked in the furniture industry. In Table 5c the nature of the industry in which the six men worked is uncertain. There is a suggestion in the material that the relative frequency of nasal tumours other than adenocarcinomas in

woodworkers outside the furniture industry is higher than in woodworkers within the furniture industry. Thus, in Table 5a, 4 of 29 furniture workers had miscellaneous nasal tumours other than adenocarcinoma, as compared with 5 of 14 in workers whose relationship with the furniture industry was non-existent or uncertain (Tables 5b and c) ($\chi^2 = 1.6$, $n = 1$, $P < 0.10$). Both these points require to be re-examined in a larger survey before a definite conclusion can be reached.

Acheson and his colleagues (1970a) have published evidence showing an increased incidence of nasal adenocarcinoma and of other nasal tumours in workers in the Northamptonshire boot and shoe industry. The risk is virtually limited to the small number of workers in the industry—principally men—who have been exposed to dusty work in the preparation and finishing departments (Acheson *et al.*, 1970b). A risk in boot and shoe repairers was also suggested. In the national survey reported here, substantially more leather workers with adenocarcinoma were ascertained than would be expected if the risk of the tumour were similar in all occupational groups (Table 4). Four patients with squamous tumours who had been leather workers were also found but only one of these qualified for inclusion in this category in Table 4, as they had left the industry after working in it for a relatively short period. The evidence is thus in harmony with that obtained from the Northamptonshire industry, in which three further cases of squamous carcinoma of the nasal cavity have occurred since the publication of the paper referred to above.

One of the most interesting and unexpected findings of this survey has been the group of tumours in persons who have been exposed to the dust of various textiles. Of the 20 patients listed in Table 6, 14 had been exposed to cotton, four to wool, one to linen, and one to fur, felt, and straw. As might be expected, many of these patients are women who worked in the industry for a relatively short period many years before the tumour developed. This adds greatly to

the problem of determining the appropriate population at risk and of calculating the number of cases which would be expected if the risk of nasal cancer were not increased. More work is therefore needed before any firm conclusions may be drawn from this material.

No additional evidence has been found in this survey in support of the tentative suggestion in the Northamptonshire study of a possible relationship between nasal adenocarcinoma and the inhalation of flour dust.

This survey was planned at a point in the progress of the studies of nasal cancer in the Buckinghamshire furniture industry when it seemed likely that there might be specific relationships between the histological type of the tumour and the external environmental cause. It was for this reason that complete ascertainment was attempted only for adenocarcinomas, study of the other histological types of nasal cancer being limited to a sample of matched controls. It is now clear that the relationship between histological type of tumour and cause are complex and that a survey of all patients with nasal cancer over a number of years should be the next step. This is being undertaken.

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