Occupational Risk for Laryngeal Cancer

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Abstract: In a case-control analysis, we studied the effects of type of employment on laryngeal cancer risk using the interview data from the Third National Cancer Survey. Effects were measured relative to the risk for those employed in a group of arbitrarily defined industries and occupations with low risk. We excluded females and controlled for age, tobacco use, alcohol use, and race in the analysis. We found ratio estimates above 3.0 for workers in the railroad industry and the lumber industry; and for sheetmetal workers, grinding wheel operators, and automobile mechanics. (*Am J Public Health* 1982; 72:369–372.)

Published reports suggest an increased risk for laryngeal cancer among workers exposed to asbestos, cutting oil, wood dust, grease and oil; among workers in the paper, metal, leather, food, and textile industries; and among barbers, drivers, and naphthalene cleaners.[1–7] With few exceptions, these reports did not control for the two most well established environmental risk factors for laryngeal cancer—tobacco and alcohol use. For this reason, and because these reports have generally been based on few cases and, except for asbestos, remain unconfirmed by other studies, these associations must be considered highly tentative. We evaluated the effects of type of employment on laryngeal cancer risk in a case-control analysis of the interview data from the Third National Cancer Survey (TNCS), controlling for possible confounding by alcohol and tobacco use.

Methods

The interview data from the TNCS have been described in detail.[8] In brief, the TNCS was a study of all cases of cancer in seven cities and two states occurring during the three-year period 1969–1971. A 10 per cent probability sample of these cancer cases was interviewed to obtain more detailed medical and epidemiologic information. We used the following information in our analyses: sex, age, race, history of alcohol use, history of tobacco use, the industrial category of primary (longest held) job and of secondary (other major) job, and the occupational category of primary job and of secondary job. We excluded all females and all TNCS interviewees with cancer of the esophagus, stomach, small intestine, colon, pancreas, liver, bladder, kidney, lung, bronchus, oral cavity, and pharynx. These exclusions were intended to eliminate cancer diagnoses thought to be strongly associated with the same occupational carcinogens as laryngeal cancer (the subject of this report), or with alcohol or tobacco use (the subject of another report).[9] After these exclusions the most common cancer sites among the controls were prostate (46 per cent), hematopoietic system (20 per cent), and rectum (18 per cent). We also excluded from our analyses all TNCS interviewees for whom any of this information was missing, thereby excluding 16 per cent of eligible cases and 20 per cent of eligible controls. The remaining study population consisted of 90 males with cancer of the larynx and 933 males with cancers of other sites, the latter constituting the control group.

We studied two aspects of the relation between laryngeal cancer and employment: the relation between laryngeal cancer and industry of employment and the relation between laryngeal cancer and occupation or job category. To study the relation between laryngeal cancer and industry of employment, we used standard techniques for case-control analysis[10,11] to estimate rate ratios for employment in specific industries relative to employment in a low-exposure group of industries. The low exposure industries were those in which workers are presumed to have relatively few carcinogenic exposures; the industries chosen were wholesale and retail trade, business services, and professional services (1970 census codes 507–748 and 758–937). For each industry, a subject was classified as having been employed in that industry if his primary job or his secondary job was in that industry. He was classified as having been employed in the low exposure group of industries only if both his primary and his secondary jobs were among the low exposure group of industries.

To evaluate the relation between laryngeal cancer and occupation, we estimated rate ratios for specific occupational categories relative to a low-exposure group of occupations. The low-exposure occupations were professionals, managers and administrators, and clerical workers (census codes 1–395). We classified subjects as having been employed in an occupational category using a method analogous to that described above for classification by industrial category.

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TABLE 1—Distribution of Cases and Controls by Covariates

	Cases		Controls	
	Number	(%)	Number	(%)
Age				
40–54	17	(19)	175	(19)
55–69	49	(54)	383	(41)
70–84	24	(27)	375	(40)
Alcohol Use				
No	15	(17)	420	(45)
Yes	75	(83)	513	(55)
Race				
White	83	(92)	802	(86)
Non-White	7	(8)	131	(14)
Tobacco Use				
None-light	5	(6)	209	(22)
Moderate	21	(23)	410	(44)
Heavy	64	(71)	314	(34)
Highest Grade of School				
1–8	38	(42)	354	(38)
9–12	32	(36)	307	(33)
13+	20	(22)	265	(28)
Unknown or missing	0	(0)	7	(1)
Geographic Area				
Atlanta	3	(3)	30	(3)
Birmingham	3	(3)	39	(4)
Colorado	10	(11)	86	(9)
Dallas-Ft. Worth	5	(6)	85	(9)
Detroit	23	(26)	216	(23)
Minn.-St. Paul	11	(12)	93	(10)
Pittsburgh	5	(6)	71	(8)
San Francisco-Oakland	30	(33)	313	(34)

Potential confounding was controlled by stratification on age (three categories), alcohol use (two categories), tobacco smoking (three categories), and race (two categories). Rate ratios were estimated using an asymptotic conditional maximum-likelihood formula for the odds ratio, unless small numbers dictated the use of the exact conditional likelihood formula and exact confidence limits.[11]

Results

Cases and controls differed by race, age, alcohol use and tobacco use, as seen in Table 1. Differences were small, however, for highest grade of school and geographic area, so that no adjustment was necessary for these latter factors.

The strong association usually found between laryngeal cancer and smoking is evident in these data; adjusted for alcohol use, race, and age, the rate ratio estimate comparing heavy cigarette smokers with light or non-smokers was 6.8, with an approximate 90 per cent confidence interval of 3.1 to 14.1. For alcohol, the rate ratio estimate comparing users with non-users was 2.5, with a 90 per cent confidence interval of 1.6 to 4.0, adjusted for age, race, and smoking.

The industry findings are summarized in Table 2, and the occupational findings in Table 3. Because our interest was in identifying industries and occupations with elevated laryngeal cancer risk, we studied only those categories in which at least two cases had worked, thereby excluding all rate ratio estimates ($\hat{RR}$) equal to zero (0 exposed cases), and excluding categories which would tend to have a more unstable $\hat{RR}$. The $\hat{RR}$ is greater than unity for workers in 12 of the 17 industrial categories studied (Table 2). Among workers in four industries—transportation equipment, general building, lumber and wood products, and railroad—the $\hat{RR}$ is 2.0 or higher, and among agricultural workers the $\hat{RR}$ is 0.6 or lower. The $\hat{RR}$ was greater than unity among workers in 19 of the 22 occupational categories studied, was 4.0 or higher among sheetmetal workers, automobile mechanics, miscellaneous mechanics and repairmen, grinding wheel operators, miscellaneous operators, and miscellaneous craftsmen (Table 3), and was 0.6 or lower for farmers and farm laborers.

Discussion

In a preliminary survey of the association of 29 cancer sites and selected occupations and industries, Williams, *et al,* analyzed the TNCS data in two ways, both of which used a case-control approach.[12] One analysis was based on the data on primary occupation and primary industry and used as controls TNCS interviewees. Their other analysis was based on the data on recent industry of employment (industry just before diagnosis), and used as controls subjects interviewed in the 1970 census. Our analysis for laryngeal cancer differed substantially from the corresponding analy-

TABLE 2—Distribution of Subjects and Estimated Effect on Laryngeal Cancer Risk for Employment Classified by Industry*,**

Industry	Census Code	Cases	Controls	Adjusted RR	90% C.I.
"Low exposure"	507–748 758–937	11	111	1.0	
Agriculture	17, 18, 19	4	23	0.6	0.2– 1.7
Agriculture Production	17	3	22	0.5	0.1– 1.5
Mining	47–57	3	9	0.9	0.2– 3.3
Coal	48	2	7	0.9	0.1– 4.0
Construction	67–77	16	75	1.5	0.7– 3.2
General Building	67	11	36	2.1	0.9– 4.9
Trade	69	2	9	1.2	0.2– 4.5
Construction, nes***	77	3	10	1.0	0.3– 3.8
Manufacturing	107–398	43	230	1.7	0.9– 3.2
Metal	139–149	8	23	1.8	0.7– 4.5
Machinery	177–198	2	6	1.3	0.2– 5.6
Transportation Equipment	219–238	14	55	2.0	0.9– 4.7
Food Products	268–298	5	15	1.5	0.5– 4.4
Lumber	107–109	3	5	3.5	0.8–14.2
Transportation	407–429	12	42	1.4	0.6– 3.1
Rails	407	7	14	3.2	1.0– 9.6
Water	419	3	6	1.7	0.4– 7.3

*Frequencies in Tables 2 and 3 are derived by summing over all age-alcohol-tobacco strata which have at least one case.
**Includes all industrial categories which have at least two cases. (Results for 24 categories are not included as they had fewer than two cases).
***nes = not elsewhere specified.

ses of Williams, *et al.* First, we included information previously ignored on secondary jobs, so that our rate ratio estimates were based on more data and were therefore more stable. Unlike Williams, *et al,* we did not study the data on recent employment because these data were missing for 81 per cent of males and because we felt that the "longest held" and "other major" jobs were more relevant as possible sources of carcinogenic exposures than were jobs held just

TABLE 3—Distribution of Subjects and Estimated Effect on Laryngeal Cancer Risk for Employment Classified by Occupation*

Occupation	Census Code	Cases	Controls	Adjusted RR	90% C.I.
"Low exposure"	1–395	8	80	1.0	
Craftsmen	401–580	31	227	1.2	0.6– 2.6
Carpenters	415	3	13	1.3	0.3– 4.6
Electricians	430	2	6	1.8	0.4– 7.8
Foreman, nes**	441	4	12	1.3	0.3– 4.4
Automobile mechanics	473	4	4	4.6	1.1– 20.5
Mechanics & repairmen, misc***	492	3	3	6.8	1.0– 99
Sheetmetal workers	535	2	1	8.5	1.0–139
Craftsmen, nes**	575	2	1	∞	1.2–∞
Operatives	601–715	33	167	1.4	0.7– 3.0
Assemblers	602	3	7	3.0	0.6– 14.3
Mine operatives, nes**	640	2	15	0.8	0.1– 3.7
Grind machine operators	651	3	0	∞	1.9–∞
Sailors	661	2	2	3.3	0.4– 27.9
Machine operators, misc	690–692	4	15	1.5	0.5– 4.9
Operator, nes**	694–695	4	7	4.5	1.2– 17.1
Truck drivers	715	5	15	1.4	0.5– 4.3
Laborers	740–785	11	43	1.6	0.7– 3.8
Construction laborers	751	3	11	1.3	0.4– 4.6
Misc. laborers	780–785	8	3	2.1	0.7– 6.2
Farmers & laborers	801–824	4	29	0.5	0.2– 1.5
Farmers (owners & tenants)	801	3	19	0.6	0.2– 2.1
Service Workers	901–984	10	51	1.1	0.4– 2.5

*Includes all occupational categories of Craftsmen, Operatives, Laborers, and Farmers which have at least two cases (results for 39 categories are not included as they had fewer than two cases).
**nes = not elsewhere specified.
***misc = miscellaneous.

before diagnosis. Second, we defined a referent (low exposure) group of industries and occupations with few carcinogenic exposures, and estimated rate ratios relative to the low exposure category, whereas Williams, *et al,* estimated rate ratios for each industry relative to all others, a technique which underestimates any effect. Third, we excluded from the control group specific cancers which may share a common etiology with laryngeal cancer, to avoid a bias which would also lead to underestimation of any effect. In their analysis of primary occupation and of primary industry of employment, Williams, *et al,* made no such exclusions.

Our rate ratio estimates for major categories of occupation are either similar to or slightly higher than those previously reported by Williams *et al,* for laryngeal cancer. For example, Williams, *et al,* reported rate ratio estimates of 1.3 for operatives, 1.0 for craftsmen, 0.9 for laborers, and 0.4 for farmers, similar to our estimates of 1.4, 1.2, 1.6, and 0.5 respectively for these occupations. Our rate ratio estimates for major categories of industry were close to the estimates which Williams, *et al,* calculated using census controls and generally higher than the estimates which they calculated using as controls TNCS interviewees. For example, based on the analysis in which they used census controls, Williams, *et al,* reported rate ratio estimates identical to ours for manufacturing ($\hat{RR}$ = 1.7) and construction ($\hat{RR}$ = 1.5); based on the analysis in which they used TNCS interviewees as controls, they reported rate ratio estimates of 0.9 for these two industries. These observations confirm that the analytic approach which we employed succeeded in reducing biases which probably contributed to underestimation of effects in some of the analyses of Williams, *et al.*

The TNCS data provide only a modest amount of information on the effect of type of employment on laryngeal cancer risk, reflecting the extreme difficulty in studying the relation between rare exposures and rare diseases, even when large data sources such as the TNCS are available. Nevertheless several findings in the present report may be considered reliable to the extent that they substantiate those of other studies. These include increased risk for workers in the construction, railroad, or food industries; and for grinding wheel operators, sheetmetal workers, and electricians.[4,6,7,12,13] On the other hand, our findings of an elevated risk for laryngeal cancer among automobile mechanics differ from the results of two death certificate studies of occupational mortality which reported proportional mortality ratios slightly below the null value for automobile mechanics.[4,13]

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