

Has the relative frequency of adenocarcinoma
to squamous carcinoma increased?

Author : P N Lee

Date : 19.1.98

1. Introduction

It has been suggested that the relative frequency of adenocarcinoma to squamous carcinoma has been increasing over time and that this may be a consequence of the shift to smoking lower tar/filter cigarettes. In this note I consider the question as to how consistently observed is the actual evidence of a rise in the adenocarcinoma/squamous carcinoma ratio. This is based on material in my files relevant to lung cancer type, with no attempt to carry out a systematic literature review. I restricted attention to papers reporting the frequency of adenocarcinoma and squamous carcinoma at different points in time from the same source. Clearly far more, but less comparable, data could be obtained by study of all the papers that have reported frequency of the different histological types at a single period in time.

2. Results

Table 1 gives the data extracted for the 21 studies I found provided useful data. The table shows, for each study, the reference, the location, the total number of lung cancers studied and the calculated adenocarcinoma/squamous ratios by period.

Using these data, Table 2 gives estimates, sorted by sex and country, of the percentage rise in the ratio per year. This is calculated as the Nth root of the rise in ratio between the last and first period studied, N being the number of years between the middle of these periods. This formula implies an exponential rise, i.e. a compounded increase, e.g. a 3.5% rise per year will produce a $(1.035)^{15} = 1.675$ or a 67.5% rise in 15 years.

From the results in Table 2 it can be seen that the great majority of the studies of men (or of the sexes combined, in which male deaths will predominate) do show a rise in the ratio. However, there is a fair amount of variation. Thus, for example, while many of the US studies show about a 3% rise per year, some studies (notably Vincent, +11.7%)

show a larger rise, while some studies show little (Beard, +1.4%) or no (Auerbach +0.3%) rise and one study a decrease (Butler, -3.5%). Also the results for Japan are variable, with a big rise in one study (Ikeda, +5.9%), virtually no change in two studies (Tsugane, +0.6%; Watanabe, +0.3%) and a decrease in another (Tanaka, -3.1%).

Where results for both sexes are available in the same study, they generally show lower rises. This is always true for the US studies, where two show a marked decline in the ratio (Beard, -7.1%); Butler, -5.0%) and most of the others only a modest increase. However there are exceptions in the Japanese studies of Tsugane and Watanabe, where marked rises are seen in females (Tsugane +3.1%; Watanabe +6.4%) but not in males, and in the study of Johnston where marked rises were seen in both sexes, higher in females (+12.0%) than in males (+6.9%).

3. Conclusion

It must be concluded that while most studies do show a rise in the adenocarcinoma/squamous carcinoma ratio, particularly in males, there are a few reported exceptions. There are also some studies where the reported rise is very large.

4. References

- 1 Auerbach O, Garfinkel L. The changing pattern of lung carcinoma. *Cancer* 1991;**68**:1973-7.
- 2 Beard CM, Annegers JF, Woolner LB, Kurland LT. Bronchogenic carcinoma in Olmsted County, 1935-1979. *Cancer* 1985;**55**:2026-30.
- 3 Butler C, Samet JM, Humble CG, Sweeney ES. Histopathology of lung cancer in New Mexico, 1970-72 and 1980-81. *J Natl Cancer Inst* 1987;**78**:85-90.
- 4 Choi J-H, Chung HC, Yoo NC, Lee HR, Lee KH, Choi W, *et al.* Changing trends in histologic types of lung cancer during the last decade (1981-1990) in Korea: a hospital-based study. *Lung Cancer* 1994;**10**:287-96.
- 5 Cox JD, Yesner RA. Adenocarcinoma of the lung: recent results from the Veterans Administration lung group. *American Review of Respiratory Disease* 1979;**120**:1025-9.

- 6 Cutler SJ, Young JL. Third National Cancer Survey: incidence data. *JNCI Monogr* 1975;**41**:1-454.
- 7 Devesa SS, Shaw GL, Blot WJ. Changing patterns of lung cancer incidence by histological type. *Cancer Epidemiol Biomarkers Prev* 1991;**1**:29-34.
- 8 Dodds L, Davis S, Polissar L. A population-based study of lung cancer incidence trends by histologic type, 1974-81. *J Natl Cancer Inst* 1986;**76**:21-9.
- 9 El-Torkey M, El-Zeky F, Hall JC. Significant changes in the distribution of histologic types of lung cancer. A review of 4928 cases. *Cancer (Phila)* 1990;**65**:2361-7.
- 10 Ikeda T, Kurita Y, Inutsuka S, *et al*. The changing pattern of lung cancer by histological type. A review of 1151 cases from a university hospital in Japan, 1970-1989. *Lung Cancer* 1991;**7**:157-64.
- 11 Johnston WW. Histologic and cytologic patterns of lung cancer in 2580 men and women over a 15-year period. *Acta Cytol* 1988;**32**:163-8.
- 12 Kacar V, Asic G, Vasic N. Distribution of the different histologic type of lung cancer among women in Yugoslavia [Abstract]. *Chest* 1996;**110(4,Sup)**:129S.
- 13 Levi F, Franceschi S, La Vecchia C, Randimbison, Te Van-Cong. Lung carcinoma trends by histologic type in Vaud and Neuchâtel, Switzerland, 1974-94. *Cancer* 1997;**79**:906-14.
- 14 Li L, Huang S, Lu Z, Wan G. Progressive changes in the relative distribution of different histological types of lung cancer in Guangzhou, China. *International symposium on lifestyle factors and human lung cancer. Dec 12-16 1994, Guangzhou, China*. 1994.Suppl 9: p. 4pp.
- 15 Perng D-W, Perng R-P, Kuo BI-T, Chiang S-C. The variation of cell type distribution in lung cancer: a study of 10,910 cases at a medical center in Taiwan between 1970 and 1993. *Jpn J Clin Oncol* 1996;**26**:229-33.
- 16 Tanaka I, Matsubara O, Kasuga T, Takemura T, Inoue M. Increasing incidence and changing histopathology of primary lung cancer in Japan. A review of 282 autopsied cases. *Cancer* 1988;**62**:1035-9.
- 17 Travis WD, Travis LB, Devesa SS. Lung cancer. *Cancer* 1995;**75**:191-202.
- 18 Tsugane S, Watanabe S, Sugiumua H, Urano Y, Matsubara S. Recent trends in different histological types of lung cancer in Tokyo based on pathological

- autopsy records. *Japanese Journal of Cancer Research* 1987;**78**:162-9.
- 19 Vincent RG, Pickren JW, Lane WW, Bross I, Takita H, Houten L, *et al.* Mounting menace in lung cancer: Adenocarcinoma. *World Smoking and Health* 1977;**2**:18-25.
- 20 Watanabe S, Tsugane S, Arimoto H, *et al.* Trend of lung cancers in the National Cancer Center of Japan and comparison with that of Japanese Pathological Autopsy Records. *Japanese Journal of Cancer Research* 1987;**78**:460-6.
- 21 Wu AH, Henderson BE, Thomas DC, Mack TM. Secular trends in histologic types of lung cancer. *J Natl Cancer Inst* 1986;**77**:53-6.
- 22 Young JL, Percy CL, Asire AJ, editors. Cancer incidence and mortality in the United States, 1973-1977. *Nat Cancer Inst Monogr* 1981;**57**:1-1082.

Table 1 Change in adenocarcinoma/squamous ratio over time in 21 studies

<u>Study</u>	<u>Location</u>	<u>Cases</u>	<u>Adenocarcinoma/Squamous carcinoma ratio by period</u>			
			<u>Pre 1978</u>	<u>1978-81</u>	<u>1981-85</u>	<u>1986-89</u>
Auerbach and Garfinkel (1991)	USA	505M	0.25	0.33	0.50	0.26
Beard et al (1985)	USA, Minnesota	388M 96F	<u>1935-54</u> 0.62 <----- 18.0 ----->	<u>1955-64</u> 0.60	<u>1965-74</u> 0.47 5.50	<u>1975-79</u> 0.96 2.43
Butler (1987)	USA, New Mexico	445M 173F	<u>1970-72</u> 0.91 2.37		<u>1980-81</u> 0.64 1.42	
Choi et al (1994)	Korea	2229M+F	<u>1981-83</u> 0.34	<u>1984-87</u> 0.47	<u>1988-90</u> 0.59	
Devesa et al (1991)	USA	27377 White M 11522 White F 4073 Black M 1419 Black F	<u>1969-71</u> 0.43 1.32 0.36 1.12		<u>1984-86</u> 0.72 1.55 0.59 1.17	
Dodds et al (1986)	USA Washington State	6128M 2769F	<u>1974-76</u> 0.58 2.0	<u>1977-78</u> 0.73 1.85	<u>1979-81</u> 0.81 2.07	
Kačar et al (1996)	Yugoslavia	1731M+F	<u>1986-90</u> 0.54		<u>1991-95</u> 0.58	
Levi et al (1997)	Switzerland	6119M 1304F	<u>1974-79</u> 0.21 1.46	<u>1980-84</u> 0.34 1.69	<u>1985-89</u> 0.35 1.67	<u>1990-94</u> 0.70 2.17
Li et al (1994)	China	1048M+F	<u>1978-84</u> 0.29	<u>1985-90</u> 0.50	<u>1990-94</u> 1.22	
Perng et al (1996)	Taiwan	10910M+F	<u>1970-77</u> 0.79	<u>1978-85</u> 1.08	<u>1986-93</u> 1.08	
Tanaka et al (1988)	Japan	223M 59F	<u>1956-64</u> 2.33 15.00	<u>1965-74</u> 1.75 3.00	<u>1975-83</u> 1.17 2.40	
Tsugane et al (1987)	Japan	3693M 1357F	<u>1974-78</u> 1.07 2.83		<u>1979-83</u> 1.10 3.30	
Vincent et al (1977)	USA Buffalo	1404M 278M	<u>1962-65</u> 0.31 1.50	<u>1966-70</u> 0.43 1.13	<u>1971-75</u> 0.94 2.18	
Wu et al (1986)	USA LA	18108M 9359F	<u>1972</u> 0.64 1.55		<u>1981</u> 0.81 1.67	
Travis et al (1995)	USA	104116M 46738F	<u>1973-77</u> 0.60 1.73		<u>1983-87</u> 0.84 1.95	
Watanabe et al (1987)	Japan	1061M 322F	<u>1966-70</u> 0.79 2.48		<u>1981-85</u> 0.83 6.27	
Ikeda et al (1991)	Japan	371M 115F	<u>1970-73</u> 0.54 2.41		<u>1986-89</u> 1.36 3.14	

Table 1 Change in adenocarcinoma/squamous ratio over time in 21 studies (continued)

<u>Study</u>	<u>Location</u>	<u>Cases</u>	<u>Adenocarcinoma/Squamous carcinoma ratio by period</u>		
			<u>1958-67</u>	<u>1972-78</u>	<u>1979-85</u>
Cox and Yesner (1979)	USA	1017M	0.76		1.03
El-Torkey (1990)	USA	3739M	0.32	0.35	0.64
		1189F	1.64	1.20	1.58
Johnston (1988)	USA	820M	0.43		0.60
		297F	0.93		1.64
Cutler and Young (1975)	USA	39185M	0.45		0.58
		12754F	1.52		1.62

Table 2 Estimated increase per year in adenocarcinoma/squamous carcinoma ratio by sex, country and study

<u>Sex</u>	<u>Country</u>	<u>Study</u>	<u>Prop. Rise</u>	<u>Length of period</u>	<u>% rise per year</u>
Male	USA	Auerbach	1.04	≈ 15	+0.3%
		Beard	1.55	32	+1.4%
		Butler	0.70	10	-3.5%
		Devesa (Whites)	1.67	15	+3.5%
		Devesa (Blacks)	1.64	15	+3.3%
		Dodds	1.40	5	+6.9%
		Vincent	3.03	10	+11.7%
		Wu	1.27	9	+2.7%
		Travis	1.40	10	+3.4%
		Cox and Yesner	1.36	10	+3.1%
		Cutler and Young	1.29	5	+5.2%
		El-Torkey	2.00	15	+4.7%
		Johnston	1.40	5	+6.9%
	Japan	Tanaka	0.50	22	-3.1%
		Tsugane	1.03	5	+0.6%
		Watanabe	1.05	15	+0.3%
		Ikeda	2.52	16	+5.9%
	Switzerland	Levi	3.33	15	+8.4%
	Male + Female	Korea	Choi	1.74	7
Yugoslavia		Kacar	1.07	5	+1.4%
China		Li	4.21	13	+11.7%
Taiwan		Perng	1.37	16	+2.0%
Female		USA	Beard	0.135	27
	Butler		0.60	10	-5.0%
	Devesa (Whites)		1.17	15	+1.1%
	Devesa (Blacks)		1.04	15	+0.3%
	Dodds		1.035	5	+0.7%
	Vincent		1.45	10	+3.8%
	Wu		1.08	9	+0.8%
	Travis		1.13	10	+1.2%
	Cutler and Young		1.07	5	+1.3%
	El-Torkey		0.96	15	-0.2%
	Johnston		1.76	5	+12.0%
	Japan	Tanaka	0.16	22	-8.0%
		Tsugane	1.17	5	+3.1%
		Watanabe	2.53	15	+6.4%
		Ikeda	1.30	16	+1.7%
	Switzerland	Levi	1.49	15	+2.7%