EPIDEMIOLOGICAL EVIDENCE ON ENVIRONMENTAL TOBACCO SMOKE AND LUNG CANCER

1. 101 epidemiological studies of lung cancer among lifelong nonsmokers have been published.

2. The overall evidence shows no statistically significant increased risk of lung cancer in relation to ETS exposure from parents in childhood, or in social situations, or to non-spousal ETS exposure at home.

3. The overall evidence shows that lung cancer risk among nonsmoking women is significantly associated with having a husband who smokes (with a similar association seen in nonsmoking men in relation to smoking by the wife, though based on fewer data). There is also evidence of a dose-response relationship,[1] with risk higher if the husband smokes more cigarettes per day or for a longer period of time. However, there are a number of reasons why this association and dose-response relationship cannot be interpreted as indicating a causal effect of ETS exposure including:

   - the association is weak and is not statistically significant in the great majority of studies: nearly 80% show no statistically significant association between smoking by the husband and the development of lung cancer;

   - some of the very largest studies show no association, including six of the nine studies involving over 400 lung cancer cases. One[2] of these reported no statistically significant association between lung cancer and any index of ETS exposure, while another[3] even reported a statistically significantly reduced risk of lung cancer for non-smoking women married to smokers;

   - almost 20% of the studies have not adjusted for age in the analysis, a standard procedure in epidemiology to avoid bias. These studies report much stronger associations with spousal exposure than are reported by studies that did use age-adjustment.

   - spousal studies are particularly susceptible to various biasing factors. These include:

     i) failure to consider diet, lifestyle, family medical history, education, socio-economic status and other factors believed to differ between smoking and non-smoking households; and

     ii) the inappropriate inclusion of some misclassified current and former smokers among the lifelong non-smokers.

   - reliance on reported rather than objectively measured ETS exposure data, and failure to publish negative studies.

   No-one has yet designed a study in such a way as to eliminate all these sources of bias. Analyses published in 2000-2002 demonstrated formally that the weak association and dose-response relationship between lung cancer and smoking by the husband would essentially disappear were proper adjustment made for age, diet, education and misclassification of smoking habits[4-6], a conclusion confirmed based on more recent data [7].

4. There is also some indication from the overall evidence that lung cancer risk among non-smokers might be weakly associated with workplace ETS exposure. However, only seven of 46 relative risk estimates are statistically significant and biases that apply to the spousal data are also likely to apply to the workplace data.

5. There is similarly weak evidence of an association with overall childhood ETS exposure. Here some of the largest studies give risk estimates below 1, but several of the moderate size studies report an increased risk.

6. Taken as a whole, the epidemiology does not provide convincing support to the claim that ETS causes lung cancer in non-smokers.

THE DATA

The tables and figures that follow summarize the key evidence in relation to:

smoking by the husband (Figure 1, Table 1),
smoking by the wife (Figure 2, Table 2),
ETS exposure in the workplace (Figure 3, Table 3), and
ETS exposure in childhood (Figure 4, Table 4).

The term "relative risk" is taken to include direct estimates of the relative risks from prospective studies, and indirect estimates (odds ratios) from case-control studies. Relative risk estimates and 95% confidence limits in Tables 1 to 4 are adjusted for covariates if adjusted data are available, and otherwise are unadjusted. Where, for some studies, the source publication provides more than one adjusted estimate, the data that are normally presented are those adjusted for most covariates. Where studies present appropriate data on numbers of cases and controls (or populations at risk) unadjusted relative risks and 95% confidence limits are calculated, or checked, as described by Morris and Gardner.[8]

Tables 1 and 2 show results for exposure to smoking by the spouse or the nearest equivalent available. Details are given in the footnotes to those tables.

Some studies reported adjusted relative risks and confidence intervals only by level of the exposure of interest. These adjusted risks and intervals were used to estimate corresponding "effective numbers" of cases and controls (or subjects at risk) at each level, which could then be combined to allow estimation of risks and intervals for overall exposure.[9]

The relative risks and 95% confidence limits are plotted graphically in the figures. In the figures, each study is represented by a square and a horizontal line. The square indicates both the value of the relative risk estimate (by its position) and the size of the study (by the area of the square, which is proportional to the inverse of the variance of the relative risk estimate, and is thus closely related to the number of lung cancers studied). The horizontal line indicates the confidence limits. By this means of presentation, large studies, which contribute more to the overall evidence, have more visual impact than small studies. The result of random-effects meta-analysis of the studies is represented at the bottom of the figure by use of a diamond, the centre of the diamond representing the relative risk and the width of the diamond representing the confidence interval.

The tables and figures are based on results from a total of 101 studies (see References to data sources, page 20). An appendix explains why results from certain other publications, which might have been thought to cite relevant data, are not included in the tables and figures.

Meta-analyses of these data are available.[10,11]

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References to text

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11. Lee PN, Forey BA, Hamling JS, Thornton A. *Detailed meta-analysis on ETS and lung cancer*. Sutton, Surrey: P N Lee Statistics and Computing Ltd; 2014. www.pnlee.co.uk/Reports.htm [Download LEE2014J]

FIGURE 1: Lung cancer and husband's smoking

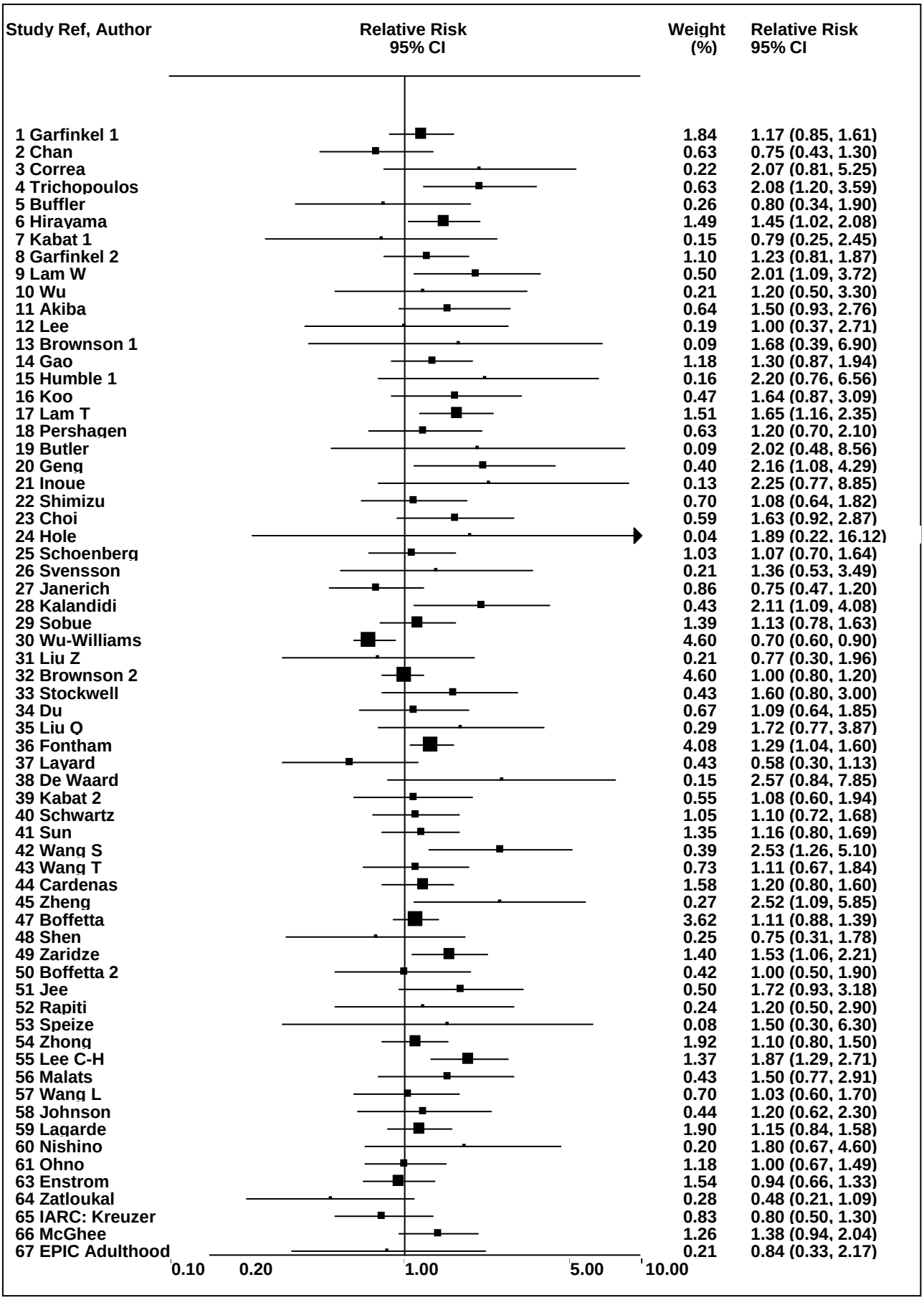

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FIGURE 1 (continued)

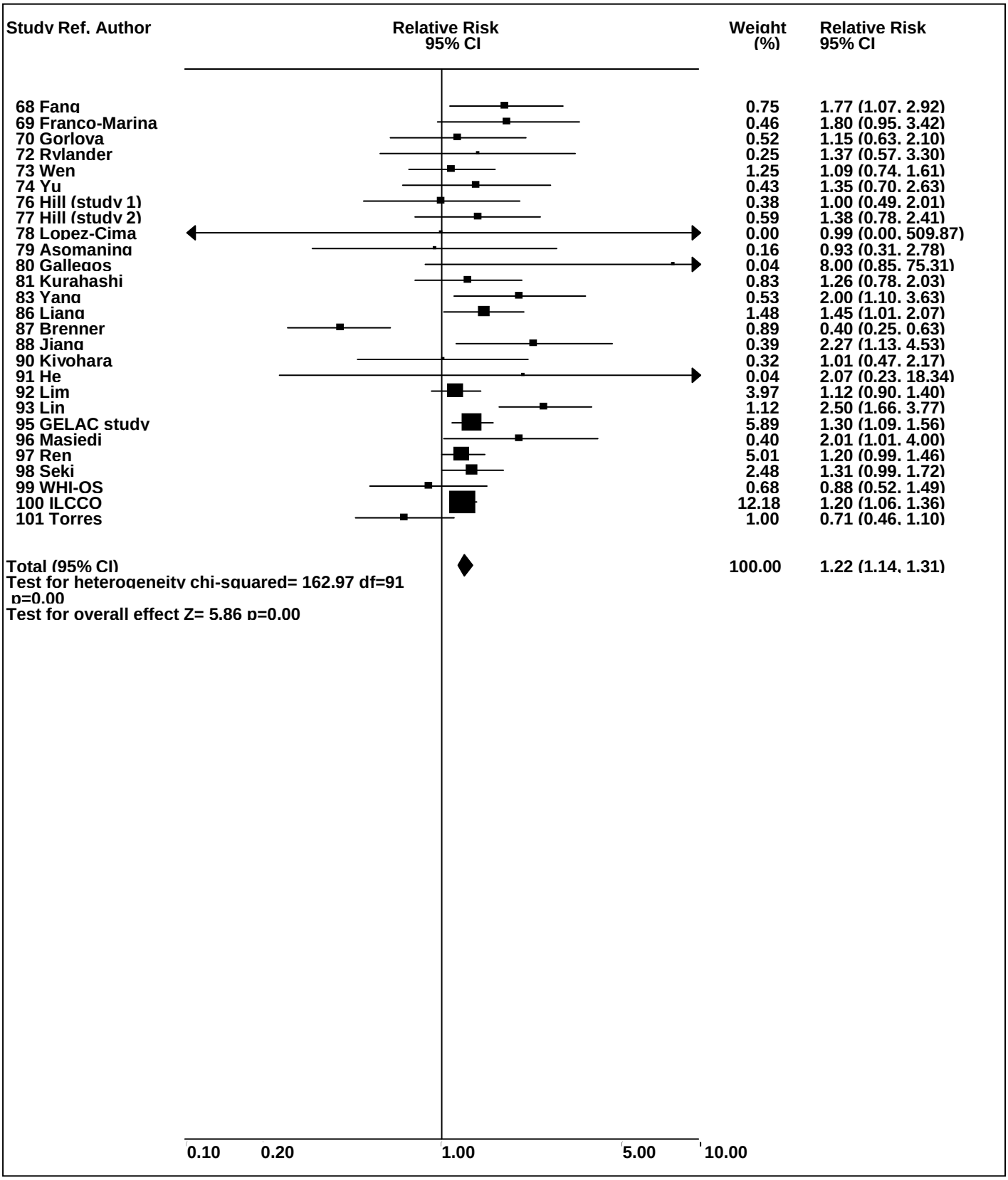

TABLE 1: Relative risk of lung cancer among lifelong nonsmoking women in relation to smoking by the husband

Study					Number of lung cancers	Relative risk (95% confidence limits)	Signi-ficance	Notes
Ref	Author	Year	Location	Type				
1	Garfinkel 1	1981	USA	P	153	1.17 (0.85-1.61)		a
2	Chan	1982	Hong Kong	CC	84	0.75 (0.43-1.30)		u
3	Correa	1983	USA	CC	24	2.07 (0.81-5.25)		u
4	Trichopoulos	1983	Greece	CC	77	2.08 (1.20-3.59)	+	u
5	Buffler	1984	USA	CC	41	0.80 (0.34-1.90)		u
6	Hirayama	1984	Japan	P	200	1.45 (1.02-2.08)	+	a
7	Kabat 1	1984	USA	CC	53	0.79 (0.25-2.45)		mr
8	Garfinkel 2	1985	USA	CC	134	1.23 (0.81-1.87)		mr
9	Lam W	1985	Hong Kong	CC	75	2.01 (1.09-3.72)	+	u
10	Wu	1985	USA	CC	31	1.20 (0.50-3.30)		a
11	Akiba	1986	Japan	CC	94	1.50 (0.93-2.76)		ar
12	Lee	1986	UK	CC	32	1.00 (0.37-2.71)		a
13	Brownson 1	1987	USA	CC	19	1.68 (0.39-6.90)		ar
14	Gao	1987	China	CC	246	1.30 (0.87-1.94)		ar
15	Humble	1987	USA	CC	20	2.20 (0.76-6.56)		ar
16a	Koo	1987	Hong Kong	CC	88	1.64 (0.87-3.09)		ar
17	Lam T	1987	Hong Kong	CC	202	1.65 (1.16-2.35)	+	u
18	Pershagen	1987	Sweden	CC	77	1.20 (0.70-2.10)		ar
19	Butler	1988	USA	P	8	2.02 (0.48-8.56)		ab
20	Geng	1988	China	CC	54	2.16 (1.08-4.29)	+	u
21	Inoue	1988	Japan	CC	28	2.25 (0.77-8.85)		a
22	Shimizu	1988	Japan	CC	90	1.08 (0.64-1.82)		mr
23	Choi	1989	Korea	CC	75	1.63 (0.92-2.87)		u
24	Hole	1989	Scotland	P	6	1.89 (0.22-16.12)		uv
25	Schoenberg	1989	USA	CC	116	1.07 (0.70-1.64)		ar
26	Svensson	1989	Sweden	CC	38	1.36 (0.53-3.49)		a
27a	Janerich	1990	USA	CC	146	0.75 (0.47-1.20)		mrz
28	Kalandidi	1990	Greece	CC	91	2.11 (1.09-4.08)	+	ar
29	Sobue	1990	Japan	CC	144	1.13 (0.78-1.63)		ar
30	Wu-Williams	1990	China	CC	417	0.70 (0.60-0.90)	-	ar
31	Liu Z	1991	China	CC	54	0.77 (0.30-1.96)		ar
32	Brownson 2	1992	USA	CC	432	1.00 (0.80-1.20)		ar
33	Stockwell	1992	USA	CC	210	1.60 (0.80-3.00)		ar
34	Du	1993	China	CC	75	1.09 (0.64-1.85)		dmr
35	Liu Q	1993	China	CC	38	1.72 (0.77-3.87)		r
36a	Fontham	1994	USA	CC	653	1.29 (1.04-1.60)	+	ar
37	Layard	1994	USA	CC	39	0.58 (0.30-1.13)		ar
38	deWaard	1995	Netherlands	CC	23	2.57 (0.84-7.85)		u
39	Kabat 2	1995	USA	CC	69	1.08 (0.60-1.94)		mr
40	Schwartz	1996	USA	CC	185	1.10 (0.72-1.68)		arz
41	Sun	1996	China	CC	230	1.16 (0.80-1.69)		ar
42	Wang S-Y	1996	China	CC	82	2.53 (1.26-5.10)	+	u
43	Wang T-J	1996	China	CC	135	1.11 (0.67-1.84)		m
44a	Cardenas	1997	USA	P	246	1.20 (0.80-1.60)		ar
45	Zheng	1997	China	CC	69	2.52 (1.09-5.85)	+	u
47b	Boffetta 1	1998	West Europe	CC	509	1.11 (0.88-1.39)		ar
48	Shen	1998	China	CC	70	0.75 (0.31-1.78)		a
49	Zaridze	1998	Russia	CC	189	1.53 (1.06-2.21)	+	ar
50	Boffetta 2	1999	Europe	CC	66	1.00 (0.50-1.90)		ar
51	Jee	1999	Korea	P	79	1.72 (0.93-3.18)		ar
52	Rapiti	1999	India	CC	41	1.20 (0.50-2.90)		ar
53	Speizer	1999	USA	P	35	1.50 (0.30-6.30)		a
54	Zhong	1999	China	CC	504	1.10 (0.80-1.50)		ar
55	Lee C-H	2000	Taiwan	CC	268	1.87 (1.29-2.71)	+	arv
56	Malats	2000	Europe/Brazil	CC	105	1.50 (0.77-2.91)		arz
57	Wang L	2000	China	CC	200	1.03 (0.60-1.70)		ar
58	Johnson	2001	Canada	CC	71	1.20 (0.62-2.30)		arv
59	Lagarde	2001	Sweden	CC	242	1.15 (0.84-1.58)		artz
60	Nishino	2001	Japan	P	24	1.80 (0.67-4.60)		ar
61	Ohno	2002	Japan	CC	191	1.00 (0.67-1.49)		acr
63	Enstrom	2003	USA	P	177	0.94 (0.66-1.33)		ar

TABLE 1 (continued) Relative risk of lung cancer among lifelong nonsmoking women in relation to smoking by the husband

Study					Number of lung cancers	Relative risk (95% confidence limits)	Signi-ficance	Notes
Ref	Author	Year	Location	Type				
64	Zatloukal	2003	Czech Republic	CC	84	0.48 (0.21-1.09)		apr
65	IARC: Kreuzer	2004	Germany	CC	100	0.80 (0.50-1.30)		ar
66	McGhee	2005	Hong Kong	CC	179	1.38 (0.94-2.04)		ar
67b	EPIC Adulthood	2005	Western Europe	P	43	0.84 (0.33-2.17)		arz
68	Fang	2006	China	CC	157	1.77 (1.07-2.92)	+	ar
69b	Franco-Marina	2006	Mexico	CC	72	1.80 (0.95-3.42)		u
70	Gorlova	2006	USA	CC	130	1.15 (0.63-2.10)		ar
72	Rylander	2006	Sweden	CC	31	1.37 (0.57-3.30)		az
73	Wen	2006	China	P	106	1.09 (0.74-1.61)		ar
74a	Yu	2006	Hong Kong	CC	213	1.35 (0.70-2.63)		ar
76	Hill (study 1)	2007	New Zealand	P	63	1.00 (0.49-2.01)		ar
77	Hill (study 2)	2007	New Zealand	P	123	1.38 (0.78-2.41)		ar
78	Lopez-Cima	2007	Spain	CC	4	0.99 (0.00-509.87)		uz
79	Asomaning	2008	USA	CC	82	0.93 (0.31-2.78)		uz
80	Gallegos	2008	Mexico	CC	13	8.00 (0.85-75.31)		uz
81	Kurahashi	2008	Japan	P	109	1.26 (0.78-2.03)		ar
83a	Yang	2008	USA	CC	74	2.00 (1.10-3.63)	+	arz
86	Liang	2009	China	CC	226	1.45 (1.01-2.07)	+	u
87	Brenner	2010	Canada	CC	110	0.40 (0.25-0.63)	-	uz
88	Jiang	2010	China	CC	98	2.27 (1.13-4.53)	+	arz
90	Kiyohara	2011	Japan	CC	49	1.01 (0.47-2.17)		az
91	He	2012	China	P	6	2.07 (0.23-18.34)		ar
92	Lim	2012	China	CC	433	1.12 (0.90-1.40)		u
93	Lin	2012	China	CC	226	2.50 (1.66-3.77)	+	u
95	GELAC	2013	Taiwan	CC	1221	1.30 (1.09-1.56)	+	ar
96b	Masjedi	2013	Iran	CC	55	2.01 (1.01-4.00)	+	u
97	Ren	2013	China	CC	764	1.20 (0.99-1.46)		ar
98	Seki	2013	Japan	CC	292	1.31 (0.99-1.72)		ar
99	WHI-OS	2013	USA	P	200	0.88 (0.52-1.49)		s
100	ILCCO	2014	International	CC	1907	1.20 (1.06-1.36)	+	arz
101	Torres-Duran	2014	Spain	CC	153	0.71 (0.46-1.10)		arz

Notes for Table 1

Not considered in Table 1:
study 46 (Auvinen) – men only,
study 62 (Rachtan) – childhood ETS exposure only,
study 71 (Neuberger) – see below,
study 75 (Zeka) – workplace ETS exposure only,
study 82 (Pandey) – see below,
study 84 (Olivo-Marston) – childhood ETS exposure only,
study 85 (Tse) – men only,
study 89 (EPIC Childhood) – childhood ETS exposure only,
study 94 (Ferreccio) – see below.

Study 34 (Du) also reported that ETS was not statistically associated with lung cancer in an earlier similar study.

Study 67 (EPIC Adulthood) reported two types of analysis, each giving estimates of relative risk. The result quoted here is from the analysis of the whole cohort using Cox's proportional hazards model. A nested case-control analysis gave an odds ratio of 1.42 (0.63-3.20). Using this value rather than the result quoted above made no difference to meta-analyses of spousal smoking.

Study 71 (Neuberger), reporting a study of lung cancer in women in Iowa, stated that "Among never smokers no significant effect of ... passive smoking ... was detected." No further detail was given.

Study 82 (Pandey), reporting a study of never-smoking women in Nepal as an abstract only, gives an odds ratio of 2.2 (1.4-3.7) for greater than 40 smoker-years exposure to ETS in adult life compared with no exposure.

TABLE 1 (continued 2) Relative risk of lung cancer among lifelong non-smoking women in relation to smoking by the husband

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Study 94 (Ferreccio), reporting a study of lung and bladder cancer in Chile, gave detailed results for childhood ETS exposure only. It was also reported that "no evidence of interaction was seen between arsenic and adult secondhand smoke exposure" but no further detail was given.

Index of exposure is based on smoking by the spouse or, if not available, the nearest equivalent as described below under 'Indices of ETS exposure used other than husband smoked'

- **Study author** is the name of the first author in the principal publication from which the data were extracted (see references).
- **Study year** is the year of that publication.
- **Study type**: CC case control; P prospective
- **Number of lung cancers** in lifelong non-smokers is study total for females. For specific exposures numbers may be lower. For some studies these numbers have been estimated.
- Where necessary, **relative risks and 95% confidence limits** were estimated from the data presented.
- **Significance**: + statistically significant increase at 95% confidence level - significant decrease.
- **Notes**: see 'Notes column' below.

Notes column:

a	Adjusted for age.
b	Based on the "Spouse-Pairs Cohort" because the "AHSMOG Cohort" was not restricted to never smokers.
c	Based on data for hospital controls. Data for population controls was not used because non-response rate was very high.
d	Based on data for two control groups combined.
m	Lifelong non-smoking cases and controls matched for age but no age adjustment in analysis.
p	Based on data for two pathological groups of lung cancer combined.
r	Adjusted or matched for other factors (shown below).
s	Assumed to be adjusted but no details given
t	Based on data by radon exposure.
u	Unadjusted for age or other factors.
v	Relative risks were presented adjusted for age but only by level of exposure.
z	Relative risks were presented for sexes combined. They were assumed to apply to each sex separately, with confidence intervals weighted according to numbers of subjects by sex.

Indices of ETS exposure used other than husband smoked

Study	Index	Study	Index
5	Household smoker smokes regularly	70	Exposed at home at least weekly
13	Presence of persons smoking 4+ hours/day	72	Exposed at home
24	Household smoker ever smoked	74	Exposed at home and/or work
26	Exposure at home and/or at work as an adult	76	Living in a smoking household
31	Smoker in household	77	Living in a smoking household
38	Urinary cotinine >9.2 ng/mg creatinine	78	Any exposure
40	Exposed at home	79	Exposed at home
42	Exposed at home and/or work	80	Any exposure
45	Household exposure	83	Any exposure
48	Any exposure	86	Exposure in adulthood
53	Exposure in adulthood	87	Exposed at home
57	Exposed at home	88	Exposed at home and/or work
58	Exposed at home	91	Exposed at home and/or work
59	Exposed at home	92	Exposed at home
64	Exposed at home and/or work >3 hrs/day	93	No details given, presumed to be any exposure
66	Exposed at home	97	Any exposure
67	Exposed at home	99	Passive smoking
68	Exposed at home and/or work for 50+ person-years	100	Exposed at home
69	Exposed at home	101	Exposed at home

TABLE 1 (continued 3) Relative risk of lung cancer among lifelong non-smoking women in relation to smoking by the husband

Factors other than age taken into account by adjustment or matching (applies to all studies considered in Tables 1-4, except where stated in the Notes)

Study	Factors
7	Race, hospital.
8	Hospital.
11	City, vital status, participation in medical examinations.
13	Income, occupation.
14	Education.
15	Ethnicity.
16	Live births, years since exposure ceased, schooling.
18	Vital status.
22	Hospital.
25	Race, education, occupation, vegetables, vital status.
26	Residence, direct/surrogate interview.
28	Years of schooling, interviewer,total energy intake, fruit consumption.
29	Education.
30	Education, study area.
31	Age of starting to cook, years of cooking.
32	History of lung disease.
33	Race, education.
34	Residence.
35	Education, occupation, living area.
36	Race, area, education, fruits, vegetables and supplemental vitamin index, family history of lung cancer, employment in high risk occupations.
37	Race.
39	Race, hospital, date of interview, years of education.
40	Race.
41	Education.
44	Race, education, blue collar employment, vegetable consumption, fat consumption, occupational exposure to asbestos, history of chronic lung disease.
47	Study centre.
49	Education.
50	Centre.
51	Socio-economic status, residence, husband's vegetable consumption, husband's occupation.
52	Residence, religion.
54	Income, vitamin C, respondent status, smokiness of kitchen, family history of lung cancer, potentially high risk occupation.
55	Residential area, education, occupation, tuberculosis, cooking fumes, fume extractor.
56	Centre.
57	Ownership of colour TV, number of cattle, prefecture, childhood ETS exposure.
58	Province, education, total fruit and vegetables.
59	Radon, SES, occupation, residence, urban/rural.
60	Alcohol, green and yellow vegetables, fruit, meat, study area, history of respiratory disease.
61	Research institution (region).
62	Beer, vodka, milk, butter, margarine, cheese, meat, fruit vegetables, carrots, spinach, siblings with cancer, tuberculosis, place of residence, any of six defined occupational exposures.
63	Race, education, exercise, body mass index (BMI), urbanisation, fruit or fruit juice inake, health status.
64	Residence, education.
65	Region.
66	Education.
67	Country, school years, energy intake, fruit and vegetable consumption, physical activity.
68	Consumption of internal organs of animals, occupational exposure to dust, bad ventilation at work, consumption of vegetables, taking vitamins, income level, age of first procreation.
69	Access to health care.
70	Race, education, socio-economic status.
73	Education, occupation, income, physical activity, BMI, intake of meat, vegetables, fruit.
74	Education, employment, history of lung diseases, family history of lung cancer, radon, kerosene use, firewood use, incense burning, mosquito coil use, years of cooking, orange/yellow vegetables, dark green vegetables, meats, citrus fruits, salted fish, pickled vegetables, multivitamins, coffee, tea.
76	Ethnicity.
77	Ethnicity, marital status, SES, household car access, tenure, small-area deprivation index.
81	Study area, alcohol, family history of lung cancer, menopausal status.
83	Any exposure (Tables 1 & 2): COPD, α_1ATD carrier status. Childhood exposure (Table 4): sex, ETS in adulthood, education, family history of lung cancer.
84	Sex, ETS in adulthood, education, family history of lung cancer.
85	Place of birth, alcohol, radon, history of lung disease, family history of cancer, meat, exposure to lung carcinogens, adoption of dust control.
88	BMI, moved to a renovated home, family history of cancer: first degree relatives and second/third degree relatives, eating fruit and/or vegetables, exercise, mental/psychological factors: lack of emotional regulation, heavy work pressure,poor sleep quality.
89	Study centre, education, alcohol, body mass index, physical activity, vegetable intake, fruit intake, non-alcohol energy intake, adulthood passive smoking.
91	Education, marital status, occupation, alcohol, BMI, diastolic BP, triglycerides, cholesterol
93	Education, eggs, fruit, tea, cooking oil fumes, age at menarche, physical activity.

TABLE 1 (continued 4) Relative risk of lung cancer among lifelong non-smoking women in relation to smoking by the husband

95	Exposure from spouse (Table 1): Education, ETS exposure from father, ETS exposure from mother. Exposure at home or work (Tables 2 & 3): Education Exposure from mother (Table 4): Education, ETS exposure from father, ETS exposure from spouse.	98	Year of recruitment, area of residence, referral status, occupation, alcohol, family history of lung cancer.
97	Family history of cancer, fuel smoke exposure, cooking oil fume exposure, interaction of p53 and MDM2 genotypes	100	Sex, race, study.
		101	Sex, radon.

FIGURE 2: Lung cancer and wife's smoking

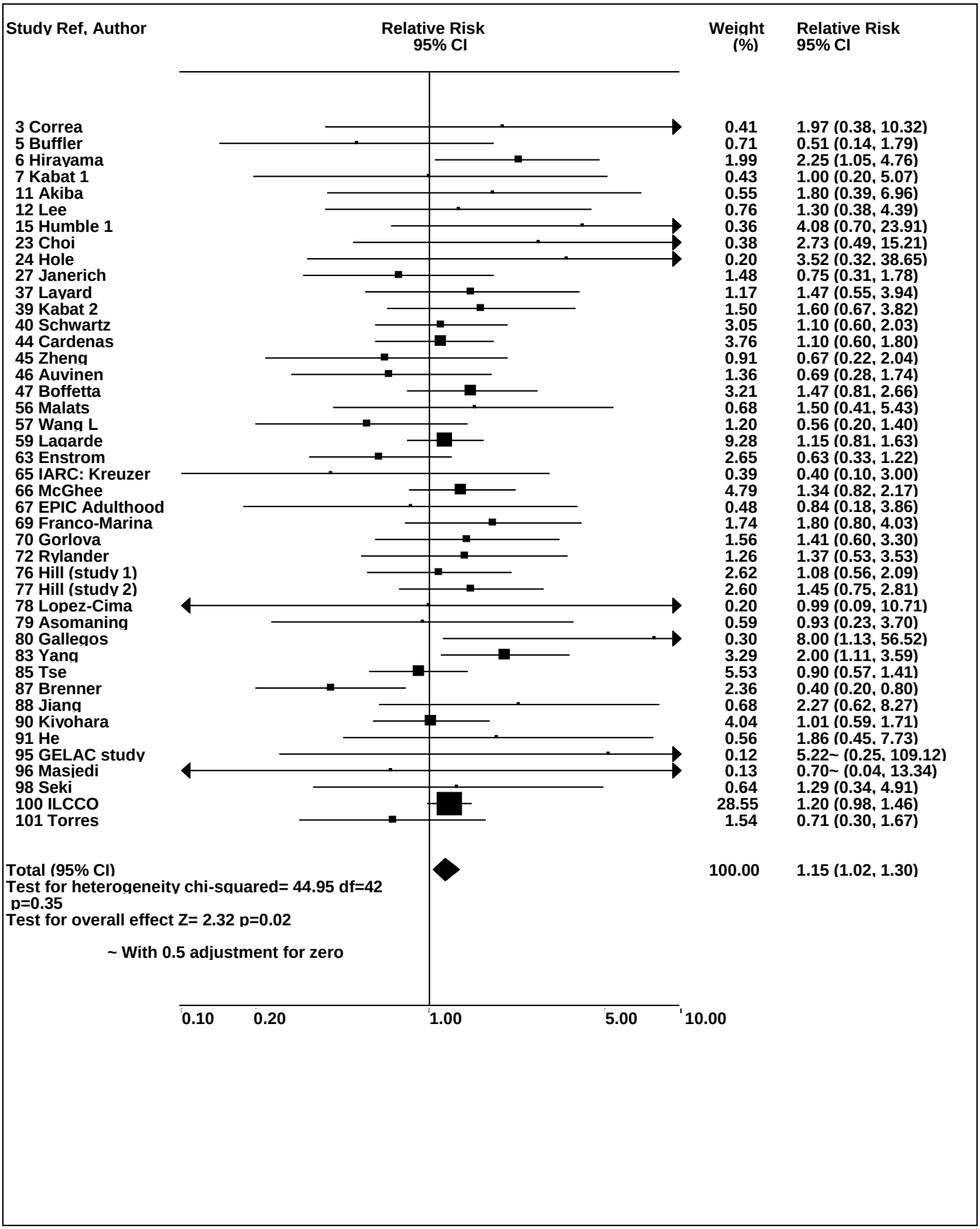

TABLE 2: Relative risk of lung cancer among lifelong nonsmoking men in relation to smoking by the wife

Study					Number of lung cancers	Relative risk (95% confidence limits)	Signi-ficance	Notes
Ref	Author	Year	Location	Type				
3	Correa	1983	USA	CC	8	1.97 (0.38-10.32)		u
5	Buffler	1984	USA	CC	11	0.51 (0.14-1.79)		u
6	Hirayama	1984	Japan	P	64	2.25 (1.05-4.76)	+	a
7	Kabat 1	1984	USA	CC	25	1.00 (0.20-5.07)		mr
11	Akiba	1986	Japan	CC	19	1.80 (0.39-6.96)		ar
12	Lee	1986	UK	CC	15	1.30 (0.38-4.39)		a
15	Humble	1987	USA	CC	8	4.08 (0.70-23.91)		ar
23	Choi	1989	Korea	CC	13	2.73 (0.49-15.21)		u
24	Hole	1989	Scotland	P	3	3.52 (0.32-38.65)		u
27a	Janerich	1990	USA	CC	45	0.75 (0.31-1.78)		mrz
37	Layard	1994	USA	CC	21	1.47 (0.55-3.94)		ar
39	Kabat 2	1995	USA	CC	41	1.60 (0.67-3.82)		mr
40	Schwartz	1996	USA	CC	72	1.10 (0.60-2.03)		arz
44a	Cardenas	1997	USA	P	116	1.10 (0.60-1.80)		ar
45	Zheng	1997	China	CC	25	0.67 (0.22-2.04)		u
46	Auvinen	1998	Finland	CC	44	0.69 (0.28-1.74)		as
47b	Boffetta 1	1998	West Europe	CC	141	1.47 (0.81-2.66)		ar
56	Malats	2000	Europe/Brazil	CC	17	1.50 (0.41-5.43)		arz
57	Wang L	2000	China	CC	33	0.56 (0.20-1.40)		ar
59	Lagarde	2001	Sweden	CC	191	1.15 (0.81-1.63)		artz
63	Enstrom	2003	USA	P	79	0.63 (0.33-1.22)		ar
65	IARC: Kreuzer	2004	Germany	CC	23	0.40 (0.10-3.00)		u
66	McGhee	2005	Hong Kong	CC	145	1.34 (0.82-2.17)		ar
67b	EPIC Adulthood	2005	Western Europe	P	16	0.84 (0.18-3.86)		arz
69b	Franco-Marina	2006	Mexico	CC	22	1.80 (0.80-4.03)		arz
70	Gorlova	2006	USA	CC	63	1.41 (0.60-3.30)		ar
72	Rylander	2006	Sweden	CC	18	1.37 (0.53-3.53)		az
76	Hill (study 1)	2007	New Zealand	P	84	1.08 (0.56-2.09)		av
77	Hill (study 2)	2007	New Zealand	P	111	1.45 (0.75-2.81)		aw
78	Lopez-Cima	2007	Spain	CC	36	0.99 (0.09-10.71)		uz
79	Asomaning	2008	USA	CC	56	0.93 (0.23-3.70)		uz
80	Gallegos	2008	Mexico	CC	19	8.00 (1.13-56.52)	+	uz
83a	Yang	2008	USA	CC	84	2.00 (1.11-3.59)	+	arz
85	Tse	2009	Hong Kong	CC	132	0.90 (0.57-1.41)		ar
87	Brenner	2010	Canada	CC	46	0.40 (0.20-0.80)	-	uz
88	Jiang	2010	China	CC	47	2.27 (0.62-8.27)		arz
90	Kiyahora	2011	Japan	CC	104	1.01 (0.59-1.71)		az
91	He	2012	China	P	10	1.86 (0.45-7.73)		ar
95	GELAC	2013	Taiwan	CC	299	5.22 (0.25-109.2)		nu
96b	Masjedi	2013	Iran	CC	26	0.70 (0.04-13.34)		pu
98	Seki	2013	Japan	CC	70	1.29 (0.34-4.91)		ar
100	ILCCO	2014	International	CC	597	1.20 (0.98-1.46)		arz
101	Torres-Duran	2014	Spain	CC	39	0.71 (0.30-1.67)		arz

Notes for Table 2

Study 34 (Du) also reported that ETS was not statistically associated with lung cancer in an earlier similar study

Study 67 (EPIC Adulthood) reported two types of analysis, each giving estimates of relative risk. The result quoted here is from the analysis of the whole cohort using Cox's proportional hazards model. A nested case-control analysis gave an odds ratio of 1.42 (0.63-3.20). Using this value rather than the result quoted above made no difference to meta-analyses of spousal smoking.

Index of exposure based on smoking by the spouse or, if not available, the nearest equivalent, as described below.

- **Study author** is the name of first author in the principal publication from which the data were extracted (see references).
- **Study year** is the year of that publication.
- **Study type**: CC case control P prospective

TABLE 2 (continued) Relative risk of lung cancer among lifelong nonsmoking men in relation to smoking by the wife

- **Number of lung cancers** in lifelong nonsmokers are study totals for males. For specific exposures numbers may be less. For some studies these numbers have been estimated.
- Where necessary, **relative risks and 95% confidence limits** were estimated from the data presented.
- **Significance**: + statistically significant increase at 95% confidence level - significant decrease.
- **Notes**: see 'Notes column' below.

Notes column:

a Adjusted for age.
m Lifelong nonsmoking cases and controls matched for age but no age adjustment in analysis.
n Estimated from numbers of subjects, with 0 exposed controls.
p Estimated from numbers of subjects, with 0 exposed cases.
r Adjusted or matched for other risk factors (see Table 1).
s Adjusted for sex; data were only given for sexes combined but as 93% of cases were male the result has been assumed to apply to males.
t Based on data by radon exposure.
u Unadjusted for age or other factors.
v Adjusted as for Hill (study 2) in Table 1.
w Adjusted for age and ethnicity only.
z Relative risks were presented for sexes combined. They were assumed to apply to each sex separately, with confidence intervals weighted according to numbers of subjects by sex.

Indices of ETS exposure used other than wife smoked

Study	Index
5	Household member smokes regularly
24	Household member ever smoked
40	Exposed at home
45	Household exposure
46	Passive smoking
57	Exposed at home
59	Exposed at home
66	Exposed at home
67	Exposed at home
69	Exposed at home
70	Exposed at home at least weekly
72	Exposed at home
76	Living in a smoking household
77	Living in a smoking household
78	Any exposure
79	Exposed at home
80	Any exposure
83	Any exposure
85	Lived with a smoker for at least a year and was exposed regularly
87	Exposed at home
88	Exposed at home and/or work
91	Exposed at home and/or work
100	Exposed at home
101	Exposed at home

FIGURE 3: Lung cancer and workplace ETS exposure

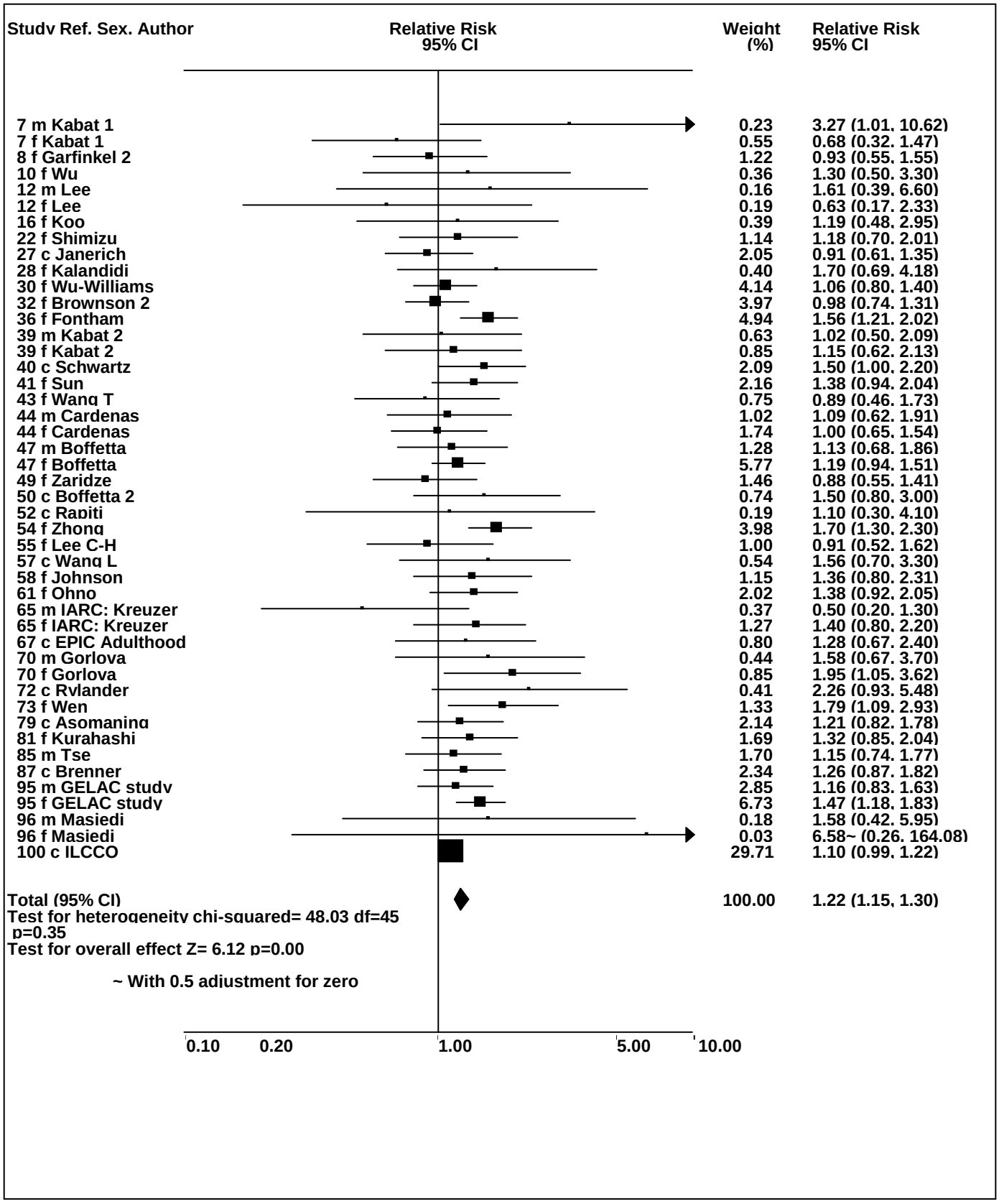

TABLE 3: Relative risk of lung cancer among lifelong nonsmokers in relation to ETS exposure in the workplace

Study Ref	Author	Location	Sex	Relative risk (95% confidence limits)	Significance	Notes
7	Kabat 1	USA	Males	3.27 (1.01-10.62)	+	mr
			Females	0.68 (0.32-1.47)		mr
8	Garfinkel 2	USA	Females	0.93 (0.55-1.55)		mr
10	Wu	USA	Females	1.30 (0.50-3.30)		a
12	Lee	UK	Males	1.61 (0.39-6.60)		u
			Females	0.63 (0.17-2.33)		u
16b	Koo	Hong Kong	Females	1.19 (0.48-2.95)		u
22	Shimizu	Japan	Females	1.18 (0.70-2.01)		mr
27a	Janerich	USA	Combined	0.91 (0.61-1.35)		mrx
28	Kalandidi	Greece	Females	1.70 (0.69-4.18)		uy
30	Wu-Williams	China	Females	1.06 (0.80-1.40)		arw
32	Brownson 2	USA	Females	0.98 (0.74-1.31)		arz
36b	Fontham	USA	Females	1.56 (1.21-2.02)	+	ar
39	Kabat 2	USA	Males	1.02 (0.50-2.09)		mr
			Females	1.15 (0.62-2.13)		mr
40	Schwartz	USA	Combined	1.50 (1.00-2.20)	?	ar
41	Sun	China	Females	1.38 (0.94-2.04)		ar
43	Wang T-J	China	Females	0.89 (0.46-1.73)		m
44b	Cardenas	USA	Males	1.09 (0.62-1.91)		ar
			Females	1.00 (0.65-1.54)		ar
47b	Boffetta 1	West Europe	Males	1.13 (0.68-1.86)		ar
			Females	1.19 (0.94-1.51)		
49	Zaridze	Russia	Females	0.88 (0.55-1.41)		ar
50	Boffetta 2	Europe	Combined	1.50 (0.80-3.00)		ar
52	Rapiti	India	Combined	1.10 (0.30-4.10)		ar
54	Zhong	China	Females	1.70 (1.30-2.30)	+	ar
55	Lee C-H	Taiwan	Females	0.91 (0.52-1.62)		ar
57	Wang L	China	Combined	1.56 (0.70-3.30)		arh
58	Johnson	Canada	Females	1.36 (0.80-2.31)		arv
61	Ohno	Japan	Females	1.38 (0.92-2.05)		ar
65	IARC: Kreuzer	Germany	Males	0.50 (0.20-1.30)		u
			Females	1.40 (0.80-2.20)		ar
67b	EPIC Adulthood	Western Europe	Combined	1.28 (0.67-2.40)		ar
70	Gorlova	USA	Males	1.58 (0.67-3.70)		ar
			Females	1.95 (1.05-3.62)	+	ar
72	Rylander	Sweden	Combined	2.26 (0.93-5.48)		a
73	Wen	China	Females	1.79 (1.09-2.93)	+	ar
79	Asomaning	USA	Combined	1.21 (0.82-1.78)		u
81	Kurahashi	Japan	Females	1.32 (0.85-2.04)		ar

TABLE 3 (continued) Relative risk of lung cancer among lifelong nonsmokers in relation to ETS exposure in the workplace

Study Ref	Author	Location	Sex	Relative risk (95% confidence limits)	Significance	Notes
85	Tse	Hong Kong	Males	1.15 (0.74-1.77)		ar
87	Brenner	Canada	Combined	1.26 (0.87-1.82)		u
95	GELAC	Taiwan	Males	1.16 (0.83-1.63)		ar
			Females	1.47 (1.18-1.83)	+	ar
96a	Masjedi	Iran	Males	1.58 (0.42-5.95)		u
			Females	6.58 (0.26-164.08)		pu
100	ILCCO	International	Combined	1.10 (0.99-1.22)	+	ar

Notes for Table 3

The Stockwell study (33) also reported finding no association but gave no detailed results.

An additional study by Zeka (75) gave results by level of exposure but in insufficient detail for an overall risk estimate to be calculated. The results presented (adjusted for occupational exposures and secondhand smoking at home) are:

Exposure level	RR (95% CI)
≤22 years exposure	0.95 (0.61-1.5)
>22 years exposure	1.30 (0.88-2.0)

- **Study author** is the name of the first author in the principal publication from which the data were extracted (see references).
- Where necessary, **relative risks and 95% confidence limits** were estimated from data presented.
- **Significance**: + statistically significant increase at 95% confidence level -significant decrease ? borderline.
- **Notes**: see 'Notes column' below.

Notes column:

a	Adjusted for age.
c	Based on hospital controls.
h	Adjusted for household ETS exposure.
m	Lifelong non smoking cases and controls matched for age but no age adjustment in analysis.
p	Estimated from numbers of subjects, with 0 exposed controls.
r	Adjusted or matched for other risk factors (see Table 1).
u	Unadjusted for age or other factors.
v	Relative risks were presented adjusted for age but only by level of exposure.
w	Estimate comes from California EPA report.
x	Risk per 150 person-years of exposure.
y	Some vs. minimal exposure.
z	Results reported in 1994 by WJ Butler in comments submitted to OSHA on their proposed indoor air quality rules, reference 31 merely reporting finding no association and giving no detailed results.

FIGURE 4: Lung cancer and childhood ETS exposure

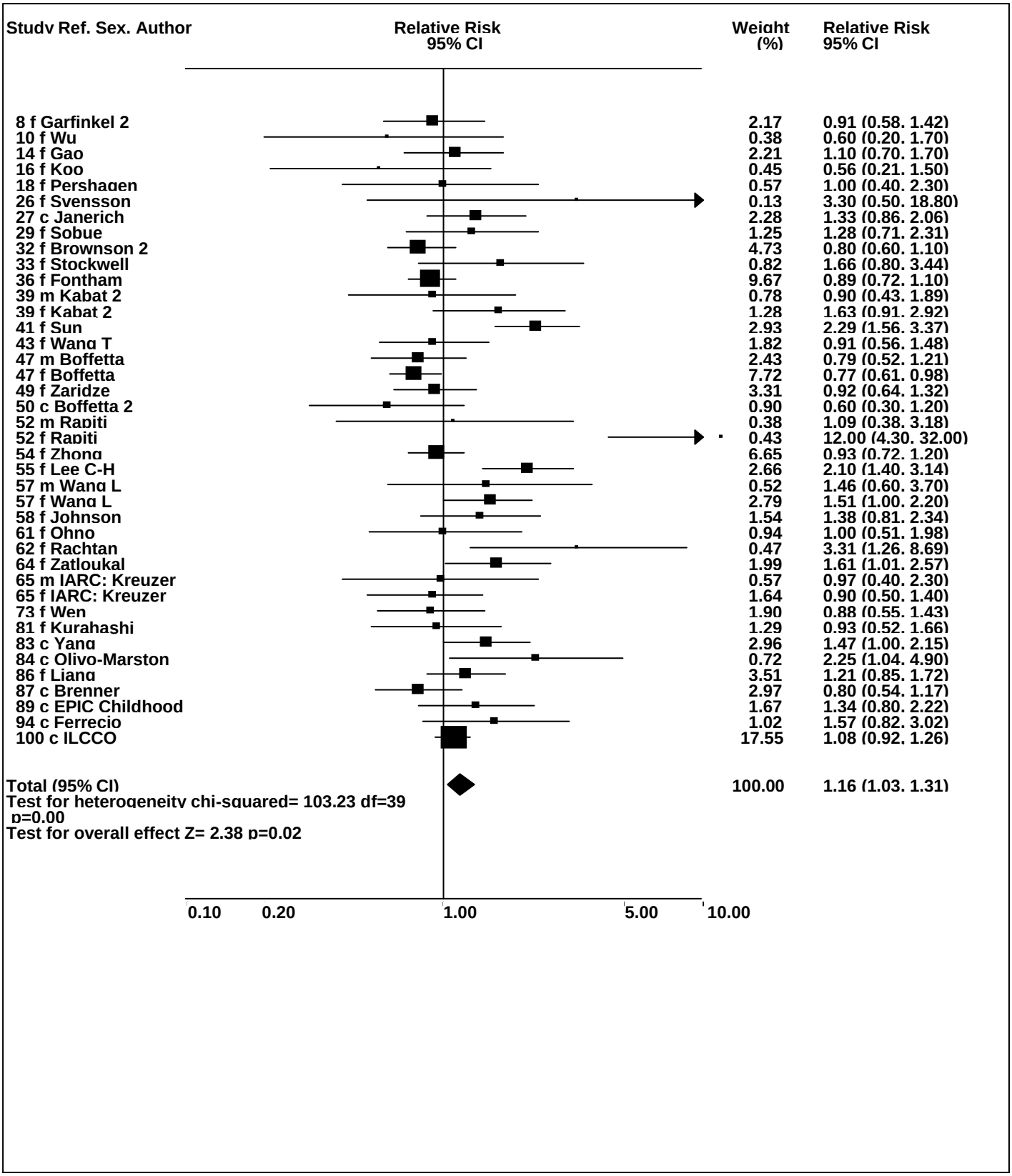

TABLE 4: Relative risk of lung cancer among lifelong nonsmokers in relation to ETS exposure in childhood

Study Ref	Author	Location	Sex	Relative risk (95% confidence limits)	Significance	Notes
8	Garfinkel 2	USA	Females	0.91 (0.58-1.42)		mr
10	Wu	USA	Females	0.60 (0.20-1.70)		a
14	Gao	China	Females	1.10 (0.70-1.70)		ar
16a	Koo	Hong Kong	Females	0.56 (0.21-1.50)		ar
18	Pershagen	Sweden	Females	1.00 (0.40-2.30)		ar
26	Svensson	Sweden	Females	3.30 (0.50-18.80)		a
27a	Janerich	USA	Combined	1.33 (0.86-2.06)		mr
29	Sobue	Japan	Females	1.28 (0.71-2.31)		ar
32	Brownson 2	USA	Females	0.80 (0.60-1.10)		ar
33	Stockwell	USA	Females	1.66 (0.80-3.44)		ar
36a	Fontham	USA	Females	0.89 (0.72-1.10)		ar
39	Kabat 2	USA	Males Females	0.90 (0.43-1.89) 1.63 (0.91-2.92)		mr mr
41	Sun	China	Females	2.29 (1.56-3.37)	+	ar
43	Wang T-J	China	Females	0.91 (0.56-1.48)		m
47b	Boffetta 1	West Europe Females	Males	0.79 (0.52-1.21) 0.77 (0.61-0.98)	 -	ar ar
49	Zaridze	Russia	Females	0.92 (0.64-1.32)		ar
50	Boffetta 2	Europe	Combined	0.60 (0.30-1.20)		ar
53	Rapiti	India Females	Males	1.09 (0.38-3.18) 12.0 (4.30-32.0)	 +	ar ar
54	Zhong	China	Females	0.93 (0.72-1.20)		ar
55	Lee C-H	Taiwan	Females	2.10 (1.40-3.14)	+	ar
57	Wang L	China	Males Females	1.46 (0.60-3.70) 1.51 (1.00-2.20)	 +	arh arh
58	Johnson	Canada	Females	1.38 (0.81-2.34)		arv
61	Ohno	Japan	Females	1.00 (0.51-1.98)		acr
62	Rachtan	Poland	Females	3.31 (1.26-8.69)	+	ar
64	Zatloukal	Czech Republic	Females	1.61 (1.01-2.57)	+	apr
65	IARC: Kreuzer	Germany	Males Females	0.97 (0.40-2.30) 0.90 (0.50-1.40)	 	ar ar
73	Wen	China	Females	0.88 (0.55-1.43)		ar
81	Kurahashi	Japan	Females	0.93 (0.52-1.66)		ar
83b	Yang	USA	Combined	1.47 (1.00-2.15)	?	ar
84	Olivo-Marston	USA	Combined	2.25 (1.04-4.90)	+	ar

TABLE 4 (continued) Relative risk of lung cancer among lifelong nonsmokers in relation to ETS exposure in childhood

Study Ref	Author	Location	Sex	Relative risk (95% confidence limits)	Significance	Notes
86	Liang	China	Females	1.21 (0.85-1.72)		u
87	Brenner	Canada	Combined	0.80 (0.54-1.17)		u
89	EPIC Childhood	Western Europe	Combined	1.34 (0.80-2.22)		ar
94	Ferreccio	Chile	Combined	1.57 (0.82-3.02)		ar
100	ILCCO	International	Combined	1.08 (0.92-1.26)		ar

Notes for Table 4

Three other studies, Correa (3), Akiba (11) and Lee YA (89), reported finding no association but gave no detailed results.

- Where the study only provided relative risk estimates for **individual sources** of ETS exposure, that for maternal smoking was used.
- Where the study provided relative risk estimates for different **time points**, that for the earliest was used.
- **Study author** is the name of the first author in the principal publication from which the data were extracted (see references).
- Where necessary, **relative risks and 95% confidence limits** were estimated from data presented.
- **Significance**: + statistically significant increase at 95% confidence level - significant decrease ? borderline.
- **Notes**: see 'Notes column' below.

Notes column

a Adjusted for age.
c Based on hospital controls.
h Adjusted for household ETS exposure.
m Lifelong nonsmoking cases and controls matched for age but no age adjustment in analysis.
p Based on data for two pathological groups of lung cancer combined
r Adjusted or matched for other risk factors (see Table 1).
u Unadjusted for age or other factors.
v Relative risks were presented adjusted for age but only by level of exposure.

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APPENDIX

STUDIES/ANALYSES NOT INCLUDED IN TABLES AND FIGURES

In preparing the tables and figures in this document certain papers which might be thought to cite relevant data have not been referred to. The studies (their year of publication, country of origin and reference) and the reasons for not referring to them are given in this appendix.

Hirayama (1981, Japan, ref A1) - results superseded by 1984 paper (ref 6).

Trichopoulos (1981, Greece, ref A2) - results superseded by 1983 paper (ref 4).

Chan (1982, Hong Kong, ref A3) - results given in other 1982 paper (ref 2).

Trichopoulos (1982, Greece, ref A4) - results superseded by 1983 paper (ref 4).

Hirayama (1983, Japan, ref A5) - results superseded by 1984 paper (ref 6).

Knoth (1983, Germany, refs A6, A7) - no control population.

Koo (1983, Hong Kong, ref A8) - results superseded by 1987 paper (ref 16a).

Gillis (1984, Scotland, ref A9) - results superseded by Hole paper (ref 24).

Hirayama (1984, Japan, ref A10) - results given in other 1984 paper (ref 6).

Miller (1984, USA, ref A11) - only five cases of lung cancer included and results for these not separately presented.

Ziegler (1984, USA, ref A12) - data only presented (by Dalager, ref A18) in combination with those of Buffler (ref 5) and Correa (ref 3). One can infer (see Lee, 1992) there was some negative association in males with ETS exposure but no relative risk estimates can be obtained.

Hirayama (1985, Japan, ref A13) - results already given in 1984 paper (ref 6).

Koo (1985, Hong Kong, ref A14) - results already given in 1984 (ref 16b) and 1987 paper (ref 16a).

Sandler (1985, USA, refs A15-17) - only two cases of lung cancer included.

Dalager (1986, USA, ref A18) - the paper only presents combined results from three studies already considered: Buffler (ref 5), Correa (ref 3) and Ziegler (ref A12).

Lloyd (1986, Scotland, ref A19) - no results presented for never smokers.

Hirayama (1987, Japan, ref A20) - results already given in 1984 paper (ref 6).

Reynolds (1987, USA, ref A21) - results presented only for cancers of smoking-related sites, and not lung cancer.

Axelson (1988, Sweden, ref A22) - study designed to investigate effects of radon and not ETS and, as such, the controls, many with smoking-related diseases, were inappropriate; furthermore, not stated whether ETS findings related to never smokers, non-smokers, or whole population.

Hirayama (1988, Japan, ref A23) - results already given in 1984 paper (ref 6).

Katada (1988, Japan, ref A24) - numbers of never smoking cases and controls unexposed to ETS too small for any sort of reliable risk estimates to be calculated.

Lam (1988, Hong Kong, ref A25) - review presenting results for three studies already considered, Chan (ref 2), Koo (ref 16) and Lam T (ref 17).

Pershagen (1988, Sweden, ref A26) - results already given in 1987 paper (ref 18).

Svensson (1988, Sweden, ref A27) - results superseded by 1989 paper (ref 26).

Hirayama (1989, Japan, ref A28) - although results are given adjusted for various dietary components, confidence intervals could not readily be calculated, so data in the 1984 paper (ref 6) were used.

Li (1989, China, ref A29) - no results presented for never smokers.

Sandler (1989, US, ref A30) - results presented only for cancers of smoking-related sites and not for lung cancer.

Wang (1989, China, ref A31) - index of ETS exposure not given, not stated whether results referred to never smokers, and relative risk not given.

Chen (1990, Taiwan, ref A32) - results seem not to be presented for never smokers, and no details given of index of ETS exposure used.

Hirayama (1990, Japan, refs A33, A34) - results already given in 1984 paper (ref 6).

Kabat (1990, USA, ref A35) - results superseded by 1995 paper (ref 39).

Liu (1990, China, ref A36) - results superseded by 1991 paper (ref 31).

Miller (1990, US, ref A37) - results concern respiratory, not lung cancer and only include three cases in spousal smoking analyses.

Sobue (1990, Japan, ref A38) - results given in other 1990 paper (ref 29).

Stellman (1990, USA, ref A39) - results already given in 1985 Garfinkel paper (ref 8).

Ye (1990, China, ref A40) - no results presented for never smokers.

Fontham (1991, USA, ref A41) - results superseded by 1994 paper (ref 36a).

He (1991, China, ref A42) - results given in 1991 Liu paper (ref 31).

Holowaty (1991, Canada, ref A43) - no results presented for never smokers.

Jöckel (1991, Germany, ref A44) - results mainly included as part of Boffetta 1 study (ref 47).

Stockwell (1991, USA, ref A45) - results superseded by 1992 paper (ref 33).

Gardiner (1992, Scotland, ref A46) - data on ETS exposure only available for 4 cases.

Ger (1992, China, ref A47) - no results presented for never smokers.

Hirayama (1992, Japan, ref A48) - results already given in 1984 paper (ref 6).

Jöckel (1992, Germany, ref A49) - results mainly included as part of Boffetta 1 study (ref 47).

Fontham (1993, USA, refs A50, A51) - results superseded by 1994 paper (ref 36a).

Ger (1993, China, ref A52) - no results presented for never smokers.

Järvholm (1993, Sweden, ref A53) - only six lung cancers in never smoking women and cited odds ratio for ETS inconsistent with data presented.

Lan (1993, China, ref A54) - index of ETS exposure not given, not stated whether results referred to never smokers and odds ratios and confidence limits cited inconsistent with each other and with tabular data given.

Siegel (1993, USA, ref A55) - review paper of lung cancer risk in food-service workers, data generally relating to smokers and non-smokers combined.

Wang (1993, China, ref A56) - believed to be based on a subset of subjects from Wu-Williams study (ref 30).

Alavanja (1994, USA, ref A57) - results already given in 1992 Brownson paper (ref 32).

Geng (1994, China, ref A58) - results already given in 1988 paper (ref 20).

Kabat (1994, USA, ref A59) - results superseded by 1995 paper (ref 39).

Miller (1994, USA, ref A60) - control group (formed from decedents from all causes of death except lung cancer) contains many with diseases associated with smoking.

Shen (1994, China, ref A61) - no results presented for never smokers, and superseded by 1998 paper (ref 48).

Wang (1994, China, ref A62) - believed to be based on subset of subjects from Wu-Williams study (ref 30).

Zaridze (1994, Russia, ref A63) - results superseded by the 1998 paper (ref 49).

Alavanja (1995, USA, ref A64) - results already given in 1992 Brownson paper (ref 32).

Du (1995, China, ref A65) - results already given in 1993 Du paper (ref 34).

Ellard (1995, UK, ref A66) - gives results for total nicotine metabolites. Results for cotinine already given in deWaard study (ref 38).

Wünsch Filho (1995, Brazil, ref A67) - no results presented for never smokers.

Auvinen (1996, Finland, ref A68) - corrected results given in 1998 (ref 46).

Dai (1996, China, ref A69) - exposure to ETS recorded (source unstated) but not significant in regression analysis and relative risk not given.

Du (1996, China, ref A70) - results already given in 1993 Du paper (ref 34).

Lei (1996, China, ref A71) - results already given in 1993 Du paper (ref 34).

Luo (1996, China, ref A72) - no results presented for never smokers.

Shen (1996, China, ref A73) - results superseded by 1998 paper (ref 48).

Shen (1996, China, ref A74) - no results presented for never smokers, and superseded by 1998 paper (ref 48).

Shen (1996, China, ref A75) - no results presented for never smokers.

Wang (1996, China, ref A76) - believed to be based on subset of subjects from Wu-Williams study (ref 30).

Yu S-Z (1996, China, ref A77) - gives pooled odds ratio for ETS from three case-control studies in China. Two of the studies are refs A31 and A42 (already rejected) and the third actually presents no ETS data at all.

Yu Z (1996, China, ref A78) - no results presented for never smokers.

Cardenas (1997, USA, ref A79) - gives corrected age-standardized results for Cardenas study (ref 44), but results used are adjusted for age and other factors.

Dai (1997, China, ref A80) - no results presented for never smokers.

Jöckel (1997, Germany, ref A81) - results mainly included as part of Boffetta 1 study (ref 47).

Ko (1997, Taiwan, ref A82) - results superseded by Lee C-H report (ref 55).

Nyberg (1997, Sweden, ref A83) - results mainly included as part of Boffetta 1 study (ref 47).

Yang (1997, USA, ref A84) - no results presented for never smokers.

Boffetta (1998, West Europe, refs A85) - results given in 1998 papers cited (ref 47).

Jöckel (1998, Germany, ref A86) - results mainly included as part of Boffetta 1 study (ref 47).

Nyberg (1998, Sweden, ref A87) - results mainly included as part of Boffetta 1 study (ref 47).

Wichmann (1998, Germany, ref A88) - results mainly included as part of Boffetta 1 study (ref 47).

Zaridze (1998, Russia, ref A89) - results superseded by other 1998 paper (ref 49).

Zemlianaja (1998, Russia, ref A90) - results superseded by 1998 Zaridze paper (ref 49).

Bennett (1999, USA, ref A91) - main results already given in 1992 Brownson paper (ref 32).

Boffetta (1999, West Europe, ref A92) - main results already given by Boffetta 1 (ref 47).

Hou (1999, Sweden, ref A93) - results superseded by 2001 Lagarde paper (ref 59).

Brennan (2000, West Europe, ref A94) - main results already given by Boffetta 1 (ref 47).

Johnson (2000, USA, refs A95, A96) - results superseded by 2001 paper (ref 58).

Kleinerman (2000, China, ref A97) - results superseded by Wang L paper (ref 57).

Ko (2000, Taiwan, ref A98) - results superseded by Lee C-H paper (ref 55).

Kreuzer (2000, Germany, ref A99) - results included as parts of Boffetta 1 study (ref 47) and IARC: Kreuzer study (ref 65).

Li (2000, China, ref A100) - no results presented for never smokers.

Zhou (2000, China, ref A101) - no results presented for never smokers.

Goldoni (2001, Italy, ref A102) - no results presented for never smokers.

Kreuzer (2001, Germany, ref A103) - results mainly included as part of Boffetta 1 study (ref 47).

Kubík (2001, Czech Republic, ref A104) - results superseded by 2003 Zatloukal paper (ref 64).

Lee (2001, Taiwan, ref A105) - no results presented for never smokers. Results for never smokers given in 2000 paper (ref 55).

Liu (2001, China, ref A106) - proved unobtainable.

Zhao (2001, Singapore, ref A107) - insufficient data presented to allow calculation of relative risk, results superseded by Lim paper (ref 92)

Zhong (2001, Shanghai, ref A108) - no results presented for never smokers.

Hu (2002, Canada, ref A109) - similar analyses to those given by Johnson (ref 58), but based on fewer controls.

Kreuzer (2002, Germany, ref A110) - results mainly included as part of Boffetta 1 study (ref 47).

Kubík (2002, Czech Republic, ref A111) - results superseded by 2003 Zatloukal paper (ref 64).

Merrill (2002, Morocco, ref A112) - abstract reporting same study as 2002 paper by Sasco (ref A115).

Miller (2002, USA, ref A113) - abstract with no relative risks cited.

Rachtan (2002, Poland, ref A114) - no results presented for never smokers. Results for never smokers given in another Rachtan paper (ref 62).

Sasco (2002, Morocco, ref A115) - no results presented for never smokers.

Seow (2002, Singapore, ref A116) - results superseded by Lim (ref 92).

Chan-Yeung (2003, Hong Kong, ref A117) - control group includes many with diseases associated with smoking.

Chen (2003, China, ref A118) - no results presented for never smokers.

Gallegos-Arreola (2003, Mexico, ref A119) - only four lung cancer cases and definition of never smoker includes current smokers of <3 cigarettes per day.

Kiyohara (2003, Japan, ref A120) - subset of subjects from Ohno study (ref 61).

Miller (2003, USA, ref A121) - ETS exposure is based on home, work and leisure activities so unexposed group may have substantial ETS exposure, e.g. home and work only.

Brennan (2004, USA and West Europe, ref A122) - combined analysis of Fontham and Boffetta 1 studies (refs 36 and 47).

Cohet (2004, Europe and Brazil, ref A123) - largely same subjects as previously reported in Malats study (ref 56). Cohet includes a few more subjects, but gives less detailed ETS analysis.

Hernández-Garduño (2004, Mexico, ref A124) - control group predominantly lung disease patients.

Behera (2005, India, ref A125) - control group with non-malignant respiratory disease and results for nonsmokers only given as "not significant."

Bock (2005, USA, ref A126) - believed to be based mainly on a subset of subjects from Schwartz (ref 40).

Holcátová (2005, Central East Europe, ref A127) - control group includes smoking-related diseases, results only for sexes combined and prevalence of smoking in controls implausibly low for partners (5%).

Ng (2005, Singapore, ref A128) - subset of Seow study (ref A116).

Wenzlaff (2005, USA, refs A129, A130) - believed to be based mainly on a subset of subjects from Schwartz (ref 40).

Yang (2005, USA, ref A131) - no results presented for never smokers.

Boffetta (2006, Norway, ref A132) - no results presented for never smokers (analyses presented as being of never smokers include former smokers who quit >5 years before enrollment).

Cassidy (2006, England, ref A133) - no results presented for never smokers.

Hemminki (2006, Sweden, ref A134) - no results presented for never smokers.

Spitz (2007, USA, ref A135) - results previously reported by Gorlova (ref 70) using a more detailed ETS exposure index (though based on slightly fewer subjects).

Veglia (2007, Western Europe, ref A136) - results not already reported previously for EPIC Adulthood (ref 67) are not for never smokers and relate to working in bars or restaurants, not overall workplace ETS exposure.

Vineis (2007, Western Europe, ref A137) - no results presented for never smokers.

Aldington (2008, New Zealand, ref A138) - no results presented for never smokers.

Gorlova (2008, USA, ref A139) - results previously reported by Gorlova (ref 70) using a more detailed ETS exposure index and with separate results for males and females (though based on fewer subjects).

Lan (2008, China, ref A140) - no results presented for never smokers.

Vardavas (2008, Greece, ref A141) - no original results, only estimates of expected numbers of cancers.

Weiss (2008, Shanghai, ref A142) - result not previously reported by Wen (ref 73) is unadjusted and is for very little extra follow-up. The estimate reported is inconsistent with the stated numbers of subjects.

Pronk (2009, Shanghai, ref A143) - the result available, for any lifetime exposure, is unadjusted, is restricted to working women and relates to the study previously reported by Wen (ref 73) in which a similar, adjusted result is available, based on only slightly fewer subjects.

Chiu (2010, Hong Kong, ref A144) - results previously reported by Wang (ref 74b) which used fuller adjustment for possible confounders.

Lee (2010, International, ref A145) - results superseded by Kim paper (ref 100)

Li (2010, USA, ref A146) - ETS only considered as a confounding variable.

Lo (2010, Taiwan, ref A147) - results superseded by 2013 paper (ref 95)

Tang (2010, Singapore, ref A148) - no results presented for never smokers.

Fowke (2011, Shanghai, ref A149) - results previously reported by Wen (ref 73).

Gorlova (2011, USA, ref A150) - results previously reported by Gorlova (ref 70) using a more detailed ETS exposure index and with separate results for males and females (though based on fewer subjects).

Karimzadeh (2011, Iran, ref A151) - no results presented for never smokers.

Lo (2011, Taiwan ref A152) - results superseded by 2013 paper (ref 95)

Raaschou-Nielsen (2011, Denmark, ref A153) - no results presented for never smokers.

Spitz (2011a, USA, ref A154) - results previously reported by Gorlova (ref 70) using a more detailed ETS exposure index and with separate results for males and females (though based on fewer subjects).

Tse (2011, Hong Kong, ref A155) - no results presented for never smokers.

Tse (2011, Hong Kong, ref A156) - results previously reported by Tse (ref 84).

Tse (2011, Hong Kong, ref A157) - no results presented for never smokers.

Bracci (2012, USA, ref A158) - no results presented for never smokers.

He (2013, China, ref A159) - no results presented for never smokers.

Mu (2013, China, ref A160) - study carried out in "non-smokers" – unclear whether this includes ex-smokers.

Fathy (2014, Egypt, ref A161) - no results presented for never smokers. In addition, although OR is presented for lung cancer risk in relation to ETS exposure, no information on ETS exposure is given for the group of lung cancer sufferers and the ETS exposed group do not appear to be suffering from lung cancer.

Kachuri (2014, Canada, ref A162) - no results presented for never smokers.

Liu (2014, China, ref A163) - results presented are from mathematical modelling and do not relate to actual lung cancer cases. No data available from which ORs can be estimated.

Ruano-Rivano (2014, Spain, ref A164) - results previously reported by Torres-Duran (ref 101) which gave additional index of exposure and dose-response relationship.

Villeneuve (2014, Canada, ref A165) - no results presented for never smokers.

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