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PASSIVE SMOKING: MYTH OR REALITY *

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Lung cancer used to be an extremely rare disease. In fact, prior to 1923, the International Classification of Diseases did not designate a code specifically for lung cancer. A steady increase in the incidence of lung cancer since the early part of this century has moved lung cancer from a rare disease to the most common cause of cancer death for both males and females. Despite progress in cancer treatment, fewer than one in ten lung cancer victims are alive five years after diagnosis.¹

For many years, the reason for the increasing lung cancer mortality was unclear. Although tobacco was linked to nasal cancer in 1761² and lip cancer in 1795,³ not until the 1920's and 1930's was tobacco seriously investigated as a cause of lung cancer. In 1928 Lombard and Doering (USA)⁴ associated heavy smoking and all cancers. In 1939 Muller and Schairer (Germany)⁵ linked smoking and lung cancer. Porter (USA)⁶ found the same association in 1945. Other studies replicated this finding, and in 1951 Doll and Hill⁷ reported the first prospective study of 40,000 British physicians which linked smoking to lung cancer. In January, 1952, Hammond and Horn (USA)⁷ reported the same relationship among a cohort of 188,000 men.

The cause for the upward trend in lung cancer incidence during the twentieth century was now clear. Just after the US Civil War, the Washington Duke family produced a milder brand of cigarette tobacco. By 1872, they sold 125,000 pounds of this milder tobacco. In 1889, James Buchanan "Buck" Duke formed the American Tobacco Company and obtained exclusive rights to the new Bonsack cigarette manufacturing machine. This one company was able to manufacture over half the 2.1 billion cigarettes sold in the US. By 1911, the American Tobacco Company cornered over 90 percent of a rapidly expanding market. With increased production efficiency, reduced price, heavy advertising and an addictive product, cigarette sales rose 78-fold between 1889 and 1938.^{8,9,10}

Today each US smoker buys, on the average, 11,600 cigarettes per year from one of the six companies which emerged from anti-trust litigation of the early 1900s. US cigarette sales totalled 584,868,000,000 cigarettes in 1983. In the words of Buck Duke, his product gave "the poor man a lot of pleasure. Where can a man get as much fun out of 15 cents as buying

* SOURCE: Office of Public Health Laboratories and Epidemiology Morbidity Report, State of Washington, Vol 1 No 2, May-June, 1984.

a pack of cigarettes and enjoying them."¹¹

Recent evidence suggests that the fun is much more personal than are the adverse health effects. Smokers inhale only about 10 percent of cigarette smoke, most of which deposits in their lungs. This smoke, which results from a puff, is called mainstream smoke. "Passive" (or ambient, forced, environmental, involuntary, secondary, sidestream, surrogate) smoke results from the lower temperature between puffs. Passive smoking constitutes 90 percent of the products of tobacco combustion.¹² About 93 percent of sidestream smoke comes from cigarettes, with the remainder from cigars and pipes.¹³ For some chemical carcinogens, sidestream smoke has up to 50 times the carcinogen concentrations¹⁴ of mainstream smoke, due to the lower burn temperatures at rest (compared to during a puff) (see Table). Thus, per volume of smoke, sidestream smoke may have more effect on non-smokers than inhaled smoke has on smokers.^{15,16}

CONCENTRATIONS OF POLYNUCLEAR AROMATIC HYDROCARBONS
AND HETEROCYCLIC COMPOUNDS IN CIGARETTE SMOKE^{17,18,19}

	Mainstream Micrgm/100 cig	Sidestream Micrgm/100 cg	Smoky Environment Nanogram/cubic meter air
Anthracene	0.2-2.2	3.9	0.5-3
Benzo[a]fluorene	4.1-18.4	75.0	39.0
Benzo[ghi]perylene	0.3-3.9	9.8	5.9-17
Benzo[a]pyrene	0.5-7.8	2.5-7.8	2.8-760
Benzo[e]pyrene	0.2-2.5	13.9	3-18.0
Fluoranthene	1-27.2	126.0	99.0
Pyrene	5-27.0	39-101.0	2-66.0

Conclusive data linking passive cigarette exposure to elevated risk of lung cancer is not available. Four studies examined the issue, and all four found an elevated lung risk, but one study did not find the elevated risk to be statistically significant. Studies in Japan,²⁰ Greece²¹ and the U.S. found excess lung cancer among non-smoking spouses of smoking partners. The Japanese population-based study found 7 lung cancer deaths per 100,000 person-years-at-risk attributable to passive smoking by non-smoking wives of smoking husbands (N=91540). The Greek hospital based investigation found 2.4 times the lung cancer risk for women married to husbands who smoke less than one pack per day and 3.4 times the risk for women married to husbands who smoke more than one pack per day (compared to non-smoking women married to non-smoking husbands). The US study found a relative risk of 1.48 for spouses with a 1 to 40 pack year exposure to passive smoke and a relative risk of 3.11 for spouses with a >40 pack-year exposure to passive smoke.

Contrary to the above studies (and others) is the American Cancer Society (ACS) study of 179,000 non-smoking women. This study, conducted between 1960 and 1972, did not find a statistically significant association between passive smoke exposure at home and lung cancer risk. The relative risk was 1.27 for women whose husbands smoked 1 to 20 cigarettes per day and 1.10 for women whose husbands smoked over 20 cigarettes.

Re-analysis of the ACS study by Repace (US EPA Office of Air and Radiation)²² may reconcile differences between the ACS study and the Japanese, Greek and other US studies. Repace argues that the ACS study failed to distinguish between women exposed to workplace smoking and those not so exposed. Although the average passive smoker inhales 1.46 mg of tobacco tars per day, Repace calculates that this is a weighted average of 1.82 mg/day from workplace exposures and 0.45 mg/day from home exposures. The workplace exposure is higher because of the greater smoke densities at work locations. By ignoring the workplace exposure, the ACS study did not identify all the passive smokers and for the same reason, did not accurately calculate the passive smoking dose. The inaccurate classification in the ACS study could reduce the power of the study to detect an effect.

Using the lung cancer risks found in the Japanese study, one expects 7 excess lung cancer deaths per 100,000 person-years exposure to passive smoking. Repace conservatively estimates that 5 such deaths occur for each one mg/day of inhaled cigarette tars. Thus, for people exposed to cigarette smoke at work (1.82 mg tar per day), we expect 9.1 (cigarette caused) lung cancer deaths per 100,000 people exposed. Home exposures (.45 mg tar/day) contribute 2.25 deaths per 100,000 people exposed.

As an exercise, we undertook to estimate the number of passive smoking related lung cancer deaths in Washington State. About 2000 lung cancer deaths occur in Washington each year. About 1700 of these result from the effects of direct cigarette smoke and 300 from other causes. Exactly how many of these result from passive cigarette smoke is impossible to know with certainty.

Since we do not know the number of people or the concentration of passive smoke exposures in Washington, we attempted to estimate. We know that approximately 30 percent of the population smokes (US average, 32.8 percent). If we assume that each smoker exposes one non-smoker to 1.42 mg tar per day, then 1,260,000 non-smoking Washingtonians are exposed. Using the estimates, cited above, of 5 deaths/mg tar daily exposure, we calculate that 89.5 lung cancer deaths per year occur because of passive cigarette smoke exposure. This, of course, is a crude and possibly conservative estimate of excess mortality from passive cigarette smoke exposure. It suggests that almost one third of the lung cancer deaths not due to the direct effects of cigarette smoke, are due to indirect effects of cigarettes.

Not all of the effects of smoke relate to lung cancer. Among smokers we observe an increased risk of laryngeal, oral, esophageal, bladder, kidney, pancreatic, stomach, and uterine cervix cancer. Smoking also increases the risk of other chronic lung diseases. Most importantly smoking doubles the risk of cardio-vascular disease death. We expect that many of these elevated risks should be apparent among passive smokers.

Passive smoking affects several vulnerable subgroups of the population more than others. Many allergy-prone and asthmatic individuals suffer immediately upon contact with cigarette smoke. Also many people with other respiratory diseases and people with reduced lung function (including many elderly) suffer from exposure to cigarette smoke.^{23,24,25,26,27,28}

The developing fetus can also be a passive smoker. Infants born to smoking mothers weigh 200 gm (7.1 oz.) less at birth, have a higher neonatal mortality risk and, for survivors, a greater chance of being malformed and disabled.²⁹

Passively smoking infants are more likely to require hospitalization and to stay longer when hospitalized³⁰ than infants of non-smoking parents. They also have triple the rate of sudden infant death syndrome (SIDS) compared to non-passively smoking infants.³¹ Children of smoking parents have more asthma,³² bronchitis and pneumonia³³ and a higher death rate³⁴ even when other risks, such as socio-economic status, are controlled. They also have more restricted activity days,³⁴ and otitis media.³⁵ Subtle effects of passive smoking have also been reported, such as decreased attention and work capacity,³⁶ increased developmental disability and respiratory problems, and more time off school or work.^{37,38,39,40}

Despite the apparent reduction in the prevalence of cigarette smoking, the problem for the non-smoker may be worse than ever before. Increasing proportions of workers in affluent nations have moved indoors to service-sector employment. US urbanites now spend 90 percent of their lives indoors.²⁸ Buildings have become tighter and more efficient year-around. Energy conservation measures reduce building ventilation.^{29,36,37,38} Older houses and new houses that are not well sealed have between 0.8 and 1.5 air changes per hour. Newer, well constructed houses and sealed older homes have between .5 and 1.0 air change per hour. Cain calculated that for each 30 percent reduction in ventilation rates, the concentration of indoor contaminants increases 43 percent.³⁹

Dangerous levels of carcinogens have been measured at many indoor locations. Benzo(a)pyrene, one of the primary chemicals which motivated the closure of Gasworks Park in Seattle, is unlikely to rise to more than 2 ng/cubic meter in the air above the park. In smoke-filled rooms, it has been measured at levels exceeding 700 ng/cubic meter of air and is often found at concentrations of 100 ng/cubic meter of air in cigarette smoke polluted environments (bars, restaurants, etc.).⁴⁰ The yearly exposure of benzo(a)pyrene from Gasworks Park for the average park user can be obtained in minutes at many bars, restaurants or other public places (including many cigarette polluted work locations).

According to the R.J. Reynolds Tobacco Company, the average passive smoker inhales only between 1/1000 to 1/100 cigarette per hour.⁴¹ If we assume that these data are reliable and that there is one passive smoker for each smoker (thus 73 million passive smokers in the U.S.) and that each passive smoker is exposed 12 hours per day, then even at a rate of 1/500 of a cigarette per hour this amounts to 1,750,000 cigarettes PER DAY "smoked" by non-smokers nationally, or nearly 3/4 of a billion cigarettes per year.

Concerns over health effects from passive cigarette smoke are hardly a myth, as some tobacco company advertisements suggest. In reality, passive cigarette smoke is likely the most dangerous air pollutant we face today.

Cited and supplemental references are available upon request - call (504) 568-5005.

SELECTED REPORTABLE DISEASES (By Place of Residence)

STATE AND PARISH TOTALS	VACCINE PREVENTABLE DISEASES					ASEPTIC MENINGITIS	HEPATITIS A AND UNSPECIFIED**	HEPATITIS B	LEGIONELLOSIS	MALARIA ***	MENINGOCOCCAL INFECTIONS	SHIGELLOSIS	TUBERCULOSIS, PULMONARY	TYPHOID FEVER	OTHER SALMONELLOSIS	UNDERNUTRITION SEVERE	GONORRHEA	SYPHILIS, PRIMARY AND SECONDARY	RABIES IN ANIMALS (PARISH TOTALS CUMULATIVE, 1984)
	MEASLES	RUBELLA*	MUMPS	PERTUSSIS	TETANUS														
TOTAL TO DATE 1983	25	10	0	10	4	95	641	281	5	8	40	55	331	3	195	21	20141	1383	27
TOTAL TO DATE 1984	8	0	0	8	1	51	333	260	1	9	53	78	275	1	146	15	21583	1036	52
TOTAL THIS MONTH	0	0	0	2	0	9	31	18	0	0	0	10	37	0	10	0	2043	103	5
ACADIA						1	1										5		
ALLEN												1	1				10		
ASCENSION												1					4		
ASSUMPTION																	5		
AVOUELLES																	2	1	2
BEAUREGARD							1										9		
BIENVILLE																	2		
BOSSIER							4										26	2	6
CADDO							4					2					227	4	13
CALCASIEU						1	1	1									136	6	
CALDWELL																	2		
CAMERON																			
CATAHOULA																	1		
CLAIBORNE																	3		2
CONCORDIA																	2		
DESOTO																			1
EAST BATON ROUGE							1	1				3					124	11	
EAST CARROLL													1				16	3	
EAST FELICIANA												1	1				4		
EVANGELINE								1				1	1		2		2		
FRANKLIN																	10		
GRANT							1										2		
IBERIA						1	1										23	5	
IBERVILLE												1			1		5	1	
JACKSON																	3		
JEFFERSON							2	3				1	4				98	8	
JEFFERSON DAVIS							1	1									8		
LAFAYETTE						2	1					1					73	7	
LAFOURCHE																	27		
LASALLE																			
LINCOLN							1										8		
LIVINGSTON							1										2	2	
MADISON																	3	1	
MOREHOUSE												2					16		
NATCHITOCHES																	13	2	1
ORLEANS								7				9					721	30	
OUACHITA						1											95	3	1
PLAQUEMINES												1					8	1	
POINTE COUPEE																	1		1
RAPIDES													3				74		19
RED RIVER												1							
RICHLAND																	15		
SABINE																			
ST. BERNARD													1				10		
ST. CHARLES																	3	1	
ST. HELENA																	1		
ST. JAMES													1				9		
ST. JOHN							2										4	1	
ST. LANDRY						2						1	2		2		32	5	
ST. MARTIN																	7		
ST. MARY								1					2				9		
ST. TAMMANY								1					2				5	1	
TANGIPAHOA															2		15	1	
TENSAS																	3		
TERREBONNE						1		2				1		1			66		
UNION																	5	1	
VERMILION							4					1			2		8	1	
VERNON																	31	2	1
WASHINGTON				2								2	1				10		
WEBSTER							5										24		3
WEST BATON ROUGE																	1	1	
WEST CARROLL																	2		
WEST FELICIANA																	6		
WINN																	4		
OUT OF STATE																	3		

* Includes Rubella, Congenital Syndrome.

** Includes 24 cases of Hepatitis Non A and Non B.

*** Acquired outside United States unless otherwise stated.

From January 1, 1984 - October 31, 1984, the following cases were also reported:

6-Amebiasis, 62-H-Flu Meningitis, 2-Leptospirosis, 1-Poliomyelitis, Paralytic, 3-Rocky Mountain Spotted Fever, 7-Tularemia.

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