CHAPTER 48

Cigarette Smoking: When, Who, How Much, and Especially Where

• Part 1. Recognition of Smoking as a Cause of Cancer and Ischemic Heart Disease

Cigarette smoking is established as a proven and very important cause of Respiratory-System Cancers, and is suspect as a contributing cause of many additional kinds of Cancer. When did this evidence develop?

1a. Warnings Which Preceded the 1964 "Surgeon General's Report"

In June 1956, at the instigation of the Surgeon General of U.S. Public Health Service, "a scientific Study Group [on relationships between smoking and health] was established jointly by the National Cancer Institute, the National Heart Institute, the American Cancer Society, and the American Heart Association. After appraising 16 independent studies carried on in five countries over a period of 18 years, this group concluded that there is a causal relationship between excessive smoking of cigarettes and lung cancer" (from pages 6-7 of the famous "Surgeon General's Report," which is in our Reference List as SurgeonGen 1964).

On July 12, 1957, after reviewing the report of the Study Group and other new evidence, the U.S. Surgeon General, Leroy E. Burney, issued a public warning: "The Public Health Service feels the weight of the evidence is increasingly pointing in one direction; that excessive smoking is one of the causative factors in lung cancer" (quoted from SurgeonGen 1964, p.7). In the November 28, 1959 issue of the Journal of the American Medical Association, Burney stated the belief of the Public Health Service that "The weight of the evidence at present implicates smoking as the principal factor in the increased incidence of lung cancer," and "Cigarette smoking particularly is associated with an increased chance of developing lung cancer" (quoted from SurgeonGen 1964, p.7).

Early in 1962, in London, a report was issued entitled "Smoking and Health: Summary and Report of the Royal College of Physicians of London on Smoking in Relation to Cancer of the Lung and Other Diseases." Its main conclusions: "Cigarette smoking is a cause of lung cancer and bronchitis, and probably contributes to the development of coronary heart disease and various less common diseases. It delays healing of gastric and duodenal ulcers" (quoted from SurgeonGen 1964, p.8).

1b. Principal Findings of the 1964 "Surgeon General's Report"

In 1964, the U.S. Public Service issued the 387-page "Surgeon General's Report" from which we have been quoting. It is formally entitled, "Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service," (PHS Publication Number 1103). The report's "Principal Findings" are summarized near its outset (abbreviated by us from pp.31-32):

• "Cigarette smoking is causally related to lung cancer in men ... The data for women, though less extensive, point in the same direction. The risk of developing lung cancer increases with duration of smoking and the number of cigarettes smoked per day, and is diminished by discontinuing smoking. In comparison with non-smokers, average male smokers of cigarettes have approximately a 9- to 10-fold risk of developing lung cancer, and heavy smokers at least a 20-fold risk. The risk of developing cancer of the lung for the combined group of pipe smokers, cigar smokers, and pipe and cigar smokers is greater than for non-smokers, but much less than for cigarette smokers."

• "Cigarette smoking is the most important of the causes of chronic bronchitis in the United States, and increases the risk of dying from chronic bronchitis and emphysema ... [For emphysema] it has not been established that the relationship is causal."

• "It is established that male cigarette smokers have a higher death rate from coronary artery disease than non-smoking males. Although the causative role of cigarette smoking in deaths from coronary artery disease is not proven, the Committee considers it more prudent from the public health viewpoint to assume that the established association has causative meaning than to suspend judgment until no uncertainty remains."

• "Pipe smoking appears to be causally related to lip cancer. Cigarette smoking is a significant factor in the causation of cancer of the larynx. The evidence supports the belief that an association exists between tobacco use and cancer of the esophagus, and between cigarette smoking and cancer of the urinary bladder in men, but the data are not adequate to decide whether these relationships are causal. Data on an association between smoking and cancer of the stomach are contradictory and incomplete."

The Requirement for Co-Action among Causes

Just before the summary above, the Report comments on co-action among causes (SurgeonGen 1964, p.31):

"It is recognized that no simple cause-and-effect relationship is likely to exist between a complex product like tobacco smoke and a specific disease in the variable human organism. It is also recognized that often the co-existence of several factors is required for the occurrence of a disease, and that one of the factors may play a determinant role; that is, without it, the other factors (such as genetic susceptibility) seldom lead to the occurrence of the disease."

1c. Is Smoke's Primary Carcinogen Really Alpha-Particle Radiation?

The carcinogenic agents from cigarette smoke may be chemical, and they may also be physical --- namely, ionizing radiation in the form of alpha particles, emitted by radioactive decay of polonium-210.

The late Dr. Edward A. Martell was a pioneer in pursuing the hypothesis that cigarette-induced Lung-Cancer results primarily from cigarette smoke's radioactive particles --- specifically from insoluble particles large enough for deposition in the bronchi, where the radioactive atoms of polonium (210, 212, 214) subsequently decay by alpha-particle emission (Martell 1974 + 1975 + 1982-a + 1982-b + 1982-c + 1983-a and 1983-b).

The delivery of polonium-210 to the lungs by cigarette smoking is a fact NOT IN DISPUTE. It has been reported for decades (for example, see Radford 1964, + Little 1965, + Hill 1965, + Holtzman 1966, + Blanchard 1967, + Radford 1977, + Winters 1982-a and Winters 1982-b, + NCRP 1984). In 1990, the BEIR-5 Report of the National Research Council acknowledged that portions of the bronchial epithelium of smokers receive a "relatively high dose (up to 0.2 Sv per year)" of radiation from this source (BEIR 1990, p.19). 0.2 Sv is equivalent to 20 rems, as stated in our Appendix A.

The role of alpha-particle radiation in smoking-induced Lung-Cancer is a very important and neglected issue --- but an issue outside the scope of this book.

1d. Cigar Smoking: Also a Carcinogen

In mid-April 1998, the National Cancer Institute (USA) released a 232-page report entitled

"Cigars: Health Effects and Trends. Monograph 9 on Smoking and Tobacco Control" (NCI 1998 in our Reference List). Monograph 9 is the work of 50 scientists, and reviews an extensive literature. The report warns:

• - Cigar smoking can cause oral, esophageal, laryngeal, and lung cancers. Regular cigar smokers who inhale, particularly those who smoke several cigars per day, have an increased risk of coronary heart disease and chronic obstructive pulmonary disease.

• - Cigar use in the USA has increased dramatically since 1993.

• - The Director of the NCI, Richard D. Klausner, M.D., comments in the Preface of Monograph 9 (pp. ii-iii): "We believe an accurate statement is that the risks of tobacco smoke exposure are similar for all sources of tobacco smoke, and the magnitude of the risks experienced by cigar smokers is proportionate to the nature and intensity of their exposure." And "To those cigarette smokers who are thinking of switching to cigars, don't be misled. Unless you substantially reduce your exposure to smoke, your risks will remain unchanged."

• Part 2. Cigarette Smoking: Growth and Decline over Time (USA, UK)

In the year 1900, cigarette smoking was very rare, both in the USA and Britain.

2a. Changes in Per-Capita Use of Cigarettes per Year, 1900-1994

In the United States, changes in the annual use of cigarettes per capita of population (smokers + nonsmokers) are shown for 1900-1994 in the list below. The source is the CDC's Morbidity and Mortality Weekly Report (MMWR), November 18, 1994, Vol.43, No.SS-3, pp.6-7, Table 1, by Gary A. Giovino et al (MMWR 1994). The data are not provided by gender (see Part 3, below).

Year	Cigarettes Used Annually per Capita (males + females, smokers + nonsmokers combined, age 18 or older)		
1900		54	~1 per week
1910		151	
1920		665	
1930		1,485	
1940		1,976	
1950		3,552	
1960		4,171	
1963	Peak	4,345	11.9 per day
1970		3,985	
1980		3,849	
1990		2,817	
1994		2,493	

Figure 48-A: Cigarettes per Day in the UK, by Gender

The growth of cigarette smoking in the United Kingdom was also spectacular, according to a 1983 report from the Royal College of Physicians of London entitled "Health or Smoking? Follow-Up Report of the Royal College of Physicians" (Royal College 1983). In our Figure 48-A, we reproduce Figure 1.1 from that report. It shows a big difference between males and females in cigarette smoking.

Rapid Benefit for Physicians Who Quit Smoking

"Health or Smoking?" includes the following comment about causality (Royal College 1983, p.3): "The conclusion that cigarette smoking was responsible for this epidemic [of male Lung-Cancer mortality in Britain] was dramatically confirmed by looking at a group of the population that was giving up smoking --- doctors. Between 1954 and 1971, the proportion of male doctors smoking cigarettes halved (43% to 21%), while that for all men in England and Wales remained about the same. Over this period, the death rate in men from lung cancer fell by 25 percent in doctors while in the general population it increased by 26 percent (Doll 1976)."

2b. Figures 48-B, 48-C: Rates of Cigarette-Use, Lung-Cancer and IHD over Time

The tabulation in Part 2a shows the dramatic decline after 1963 of per capita cigarette-use in the USA. Our Figure 48-B depicts on a single graph (a) the growth and decline in annual per capita cigarette consumption in the USA (smokers and nonsmokers combined, genders combined), and (b) age-adjusted National Lung-Cancer MortRates for males, USA, back to 1930 (although Texas was not yet reporting in 1930; our Chapter 4).

The key point to note in Figure 48-B is that growth in per capita cigarette-consumption predicts growth in male Lung-Cancer mortality about 20 years LATER. Moreover, about 20 years after the decline began in cigarette-consumption, the male National Lung-Cancer MortRate appears to respond --- by ceasing its growth.

Quite different is the relationship of two curves in our Figure 48-C. In that figure, we plot (again) the nation's history of per capita cigarette consumption, this time with male MortRates from Ischemic Heart Disease. Both curves peak at the same time.

2c. Who Quits Smoking? Behavior and Formal Education: Box 1

Decline in cigarette consumption does not occur at random. The same issue of MMWR (Nov. 18, 1994, Table 2) presents compelling evidence that the greater the years of formal education, the greater is the decline between 1966 and 1991 in percentage of adults, >= 25 years of age, who are current smokers. Those data are presented in our Box 1.

• Part 3. Males, Females: Differences in Past Smoking Behavior

Box 2 shows the National MortRates in each decade from All-Cancers, Respiratory Cancers, and Difference-Cancers, and it calculates the growing percentages of All-Cancers contributed by Respiratory Cancers. Between the genders, there are marked differences, both in the Respiratory-Cancer MortRates and in the percentages of All-Cancers. The much lower rates and percentages for females are not surprising, in view of other data (below) which indicate that SMOKING-behavior in the past has been considerably less intense for females than for males in the USA.

• 1959-1960. In 1961, a paper entited "Smoking Habits of Men and Women" by Hammond and Garfinkel (Hammond 1961) was published in the Journal of the National Cancer Institute. It is based on questionnaires answered in 1959-1960 by 43,000 adult Americans (age 30 or older) in 1,121 counties of 25 states. Among the findings: "Exposure to cigarette smoke is far less in the female than in the male population, as indicated by percent of heavy cigarette smokers [Table 4], degree of inhalation, nicotine and tar content of cigarettes, and age at which smoking was begun [Table 3]" (Hammond 1961, p.419). Hammond's Table 4 reports on "Current Regular Cigarette-Smoking by Number of Cigarettes per Day." For all ages combined, the gender-difference is shown below. Each percentage refers to the TOTAL sample (smokers + nonsmokers):

Current Cigarette Smoking, by Gender, 1959-1960		Males, Percent	Females, Percent
People currently NOT smoking regularly -->		53.3	72.7
Total who smoke cigarettes regularly -->		46.7	27.3
Number cigarettes smoked / day:	1-9	5.4	7.1
	10-19	8.8	8.2
	20	17.3	8.6
	21-39	9.2	2.4
	40	4.6	0.8
	41+	1.0	0.1
	Uncertain	0.3	--

• 1986. In an article entitled "Cigarette Smoking in the United States, 1986," the Morbidity and Mortality Weekly Report provides estimates for the 1986 prevalence of current smoking in persons age 17 or older. "Current cigarette smokers are defined as persons who have smoked at least 100

cigarettes in their lifetime and who are currently smoking cigarettes" (MMWR 1987, Vol.36, No.35, p.581, September 11, 1987). Results (from pp.582-583), based on survey by telephone of 13,031 respondents, indicate that the male-female difference narrowed a great deal after 1960:

Gender	Percent current smokers	Mean cigarettes / day
Male	29.5	22.8
Female	23.8	19.1

The same article presented estimates by gender, back to 1944. For males, the peak estimate of 54.2% for "percent current smokers" occurred in 1955, whereas for females, the peak estimate of 36% occurred in 1944 (a Gallup Poll). While not all the percentages are reliable, one can probably believe that a much lower percentage of females than males has EVER smoked cigarettes, if percents in all decades are averaged.

Such an inference is well supported by inspection of the female MortRates from Respiratory-System Cancers, in Box 2, Column B. In every decade from 1940 through 1988, the female rates are always much lower than the male rates. Indeed, the fact that the female rates are 3.3 in 1940, when the male rates are 11.0, is consistent with the likelihood that female smokers in the USA, like female smokers in the UK, adopted the smoking habit later and less intensely than males (Figure 48-A).

• 1995. In an article entitled "State-Specific Prevalence of Cigarette Smoking --- United States, 1995," the Morbidity and Mortality Weekly Report presents estimates for the 1995 prevalence of current smoking in persons age 18 or older, by states. Current cigarette smokers are defined as described above. Median values (from MMWR, Vol.45, No.44, November 8, 1996, p.963) are:

	Nat'l	Kentucky = highest	Utah = lowest
Male	24.7%	28.8%	16.4%
Female	20.9%	26.9%	10.0%

• Part 4. What Past Smoking-Data Are Available by States and Gender?

In order to ascertain whether or not the Nine Census Divisions have been approximately alike in smoking-intensity, we tried to acquire data back to 1930 (or earlier), by states and by gender. State-by-state data (which could be combined appropriately into Census Divisions) could quantify the distribution of this carcinogen among the Census Divisions, by decades. Additionally, gender-specific data would be extremely valuable because of the evidence that, as of 1960, fewer females than males were cigarette smokers and that females smoked a lot less intensely than male smokers (Part 3, above).

4a. Non-Existence of the Data We Sought

When our search at the medical library of the University of California at San Francisco did not yield data of the types we sought, we requested advice from the Office on Smoking and Health at the U.S. Centers for Disease Control and Prevention ("CDC"). Dr. Alyssa Easton responded with the following news, with respect to state-by-state estimates of cigarette-smoking prevalence:

1) The Behavioral Risk Factor Surveillance System (BRFSS) includes state-specific estimates of smoking prevalence. But it has been conducted only since 1984. At that time, only 15 states participated. The survey has been conducted annually, but participation by all 50 states did not occur until 1995.

2) The Current Population Survey began data-collection in 1985, with tobacco supplements conducted in 1985, 1989, and 1992-1993. "There is no pre-1985 information."

Indeed, it was June 1996 when the Council of State and Territorial Epidemiologists made a recommendation discussed in MMWR November 8, 1996, Vol.45, No.44, p.962:

"State-specific surveillance of the prevalence of cigarette smoking can be used to direct and evaluate public health interventions to reduce smoking and the burden of smoking-related diseases on society. In June 1996, the Council of State and Territorial Epidemiologists (CSTE) recommended that

cigarette smoking be added to the list of conditions designated as reportable by States to CDC. This report [MMWR, November 8, 1996] responds to the CSTE recommendation and summarizes state-specific prevalences of cigarette smoking by U.S. adults in 1995."

Figure 48-D: Inverse Relationship for Smoking Prevalence 1995, PhysPop 1990

Figure 48-D regresses the 1995 smoking prevalences (male) by Census Divisions on 1990 PhysPops, and depicts the regression-input (boxy symbols) and line of best-fit. The correlation is inverse, with an R-squared value of 0.3568 and a ratio of -1.97 for X-Coef/SE. The relationship for the females (not shown) also is negative, but the R-squared value of 0.1237 from the female data has no significance. Since smoking habits in Census Divisions do not change "overnight," the inverse relationships in these recent data may indicate that relationships were inverse in earlier decades too. It is very disappointing that data by states and gender do not exist for the earlier decades.

Prevalence of Smoking: Not Informative about Intensity of Smoking

The prevalence-surveys of the Behavioral Risk Factor Surveillance System reveal nothing about the intensity of smoking among the smokers. The procedure is a state-based, random-digit-dialed telephone survey of the non-institutionalized U.S. population aged >= 18 years. Respondents are asked, "Have you smoked at least 100 cigarettes in your entire life?" and "Do you smoke cigarettes now?" Persons who answer yes to both questions are designated as "Current Smokers" (MMWR 1996, p.962).

4b. Bottom Line: Applying Reason to the Available Data

Despite the non-existence of the specific data which we would have liked to acquire, we are not helpless. In Part 5, we apply some reasoning to the two types of data which we DO have: PhysPops and MortRates.

• Part 5. No Reasonable Doubt: Smoking and PhysPop Become Inversely Related by Census Divisions

In Chapter 47, we established that the ranking of the Nine Census Divisions, by Averaged PhysPops, is quite steady during the 1940-1990 period. Indeed, Part 2 of Table 47-A shows that:

• The TopTrio (the three Census Divisions with the HIGHEST Mean PhysPops) always consisted of Mid-Atlantic, New England, and Pacific.

• The MidTrio always consisted of East North Central, West North Central, and Mountain --- until the 1990 PhysPops demoted West North Central to the LowTrio.

• The LowTrio always consisted of West South Central, South Atlantic, and East South Central --- until the 1990 PhysPops elevated South Atlantic into the MidTrio.

5a. The Relationship between MortRate Changes and PhysPop-Levels

Now we turn attention to the MortRate data for Respiratory-System Cancers in males, since females have a much less intense history of cigarette smoking (Part 3, above). In dramatic contrast to the post-1940 behavior of male MortRates for any other set of cancers, the National male MortRate for RESPIRATORY-SYSTEM Cancers rose from 11.0 in 1940, to 59.4 in 1980, and 59.7 in 1988 (Box 2). During the same period, male MortRates for All-Cancers EXCEPT Respiratory (that is, Difference Cancers) remained steady, in the range of 104.0 to 111.2 (also Box 2).

Box 2 obscures a key fact, however, because it is limited to the National rates. Box 3 shows that the spectacular rise in male Respiratory Cancers was VERY UNEVENLY distributed across the Census Divisions by 1988.

Box 3 compares the Top, Mid, and Low Trios for the MAGNITUDE OF CHANGE since 1940 in their Respiratory-Cancer MortRates. Change in a MortRate can be (and commonly is) expressed in either of two ways: As a ratio ("The new rate is 2.3 times higher than the old rate"), or as a difference

("The new rate is higher by 50 per 100,000"). Box 3 expresses change in both ways. Box 3 looks at 1960 as well as 1988.

- Comparison of Column A with Column G in Box 3 shows that the male MortRates from Respiratory Cancer increased enormously in EVERY Census Division, between 1940 and 1988.

- Column J measures the changes by subtraction (the 1988 rates minus the 1940 rates). Column K presents the average difference which developed in each Census Trio by 1988.

- Column H measures the changes by ratios (the 1988 rates divided by 1940 rates). Column I (Eye) shows the average ratio which developed in each Census Trio by 1988.

- In the Census Divisions where Mean PhysPop values are lowest (LowTrio), the average growth-ratio and growth-difference for Respiratory Cancers are highest.

- In the Census Divisions where Mean PhysPop values are highest (TopTrio), the average growth-ratio and growth-difference for Respiratory Cancers are lowest.

5b. Conclusion from These Facts: PhysPop and Smoking Inversely Related

The findings in Box 3 seem beyond challenge. What do they mean? They clearly mean that some cause of male Respiratory Cancers became much more intense in the LowTrio Census Divisions than in the HighTrio Census Divisions.

The identity of "some cause" can NOT be medical radiation. Mean PhysPop values have been persistently the lowest in the LowTrio Census Divisions (Table 47-A, Part 2). Mean PhysPop values grew in ALL the Trios between 1940 and 1988, but the growth-factor in the LowTrio was a mere 7% higher by 1988 than in the TopTrio (Table 47-B). This 7% disparity alone certainly can NOT explain why the Respiratory MortRate rose by a factor of 11.1 in the LowTrio, while rising by a factor of 3.9 in the Top Trio (Box 3, Column Eye). The explanation has to be that males in the LowTrio experienced some OTHER cause of Respiratory Cancers more intensely than did males in the TopTrio.

The identity of "some other cause" is almost surely cigarette smoking. After all, it is a PROVEN cause of Respiratory Cancer. And the time-frame is consistent with Figure 48-B. While the explanation of the facts in Box 3 MIGHT not be cigarette smoking, what matters is the evidence in Box 3 that, "beyond a reasonable doubt," SOME co-actor other than medical radiation has operated with greater intensity in the LowTrio Census Divisions than in the TopTrio Census Divisions. The name of this co-actor is not the issue. From here on, we will name it "smoking," because we think it is. But what really MATTERS is this:

A carcinogenic co-actor for Respiratory Cancers (which become a large constituent of All-Cancers by 1988) becomes INVERSELY related with the variable, PhysPop, whose correlation with Cancer we intend to analyze from 1950 to 1988. The inverse relationship of these two co-actors will result in false "findings" (Chapter 5, Part 7), if we fail to make appropriate adjustments.

In dose-response studies, appropriate adjustments are those which yield a reasonable approximation of what WOULD have been observed, if all variables (except the variable under study) had been WELL MATCHED across the dose-groups. "Adjusted data" are routinely used in the biomedical literature. Indeed, many studies make different adjustments in their data for three, four, five or more variables. Generally, readers are told only that adjustments have been made, but papers in journals rarely explain what was done. Readers who want to check the transformations, of observed data into adjusted data, must request aid from the paper's authors.

By contrast, we will make the necessary smoking-adjustment in full view. The next chapter explains each step. Many readers will skip over such steps, but all readers will be able easily to compare the "before and after" MortRate values, each time we make a MortRate adjustment in any chapter. Although showing our routine adjustment adds numerous pages to this part of the book, we feel strongly that real-world observations should not be adjusted "in the dark."

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Box 1 of Chap. 48
Years of Formal Education and Post-1965 Smoking Behavior

• - The data (for males and females combined) come from interviews of people age 25 and older. The entries (rates per 100) represent the percentage who qualified as current smokers. The data below come from Morbidity and Mortality Weekly Report (MMWR), November 18, 1994, Vol. 43, No.SS-3, Table 2.

Year of Interview	Number of years of education: <12	12	13-15	>=16
1965	--	--	--	--
1966	41.7	44.7	44.8	35.3
1970	37.5	39.3	38.7	28.8
1974	37.8	38.8	37.9	28.8
1978	35.7	37.0	34.3	24.2
1979	35.1	35.3	35.2	23.7
1980	35.1	35.4	33.9	24.5
1983	34.7	34.9	32.1	20.6
1985	34.2	33.4	30.6	19.0
1987	34.2	32.9	28.2	16.6
1988	32.9	32.7	28.1	16.3
1990	30.8	30.1	24.6	13.9
1991	31.4	30.6	25.5	13.9
Change from 1965 through 1991, converted to %	(41.7-31.4) / 41.7 = 0.247 Down by 24.7%	(44.7-30.6) / 44.7 = 0.315 Down by 31.5%	(44.8-25.5) / 44.8 = 0.431 Down by 43.1%	(35.3-13.9) / 35.3 = 0.606 Down by 60.6%

Related text = Part 2c.

Box 2 of Chap. 48
Males, Females: Share of All-Cancer from Respiratory Cancers, 1940-1988

MALES, NATIONAL

Col. C entries are Col.A entries minus Col.B entries.
Col.D entries are Col.B entries divided by Col.A entries, then converted to percents.

	Col.A AllCancer MortRate. Table 6-B	Col.B RespSystCa MortRate. Table 16-B	Col.C Diff-Cancer MortRate. Table 18-B	Col.D Share of All Cancers from Respiratory System (Col.B / Col.A)
1940	115.0	11.0	104.0	9.57%
1950	132.8	21.6	111.2	16.27%
1960	145.7	35.2	110.5	24.16%
1970	155.1	47.3	107.8	30.50%
1980	164.5	59.4	105.1	36.11%
1988	162.7	59.7	103.0	36.69%

FEMALES, NATIONAL

1940	126.1	3.3	122.8	2.62%
1950	123.2	4.6	118.6	3.73%
1960	114.9	5.3	109.6	4.61%
1970	111.7	11.7	100.0	10.47%
1980	108.5	18.0	90.5	16.59%
1988	111.3	24.5	86.8	22.01%

• - At the same time when age-adjusted MortRates from Respiratory-System Cancers were soaring in each sex, the MortRates for all other types of cancer combined in Column C were either flat (males) or decreasing (females).

Related text = Part 3.

Box 3, Chap. 48

Respiratory-System Cancers, Males: Post-1940 Change in MortRates by Census Trios

1960 vs. 1940, by Trios: Col.D expresses change by ratios. Col.F expresses change by subtraction.
1988 vs. 1940, by Trios: Col.I expresses change by ratios. Col.K expresses change by subtraction.
MRs change inversely with PP. High-PP Trio has lowest growth-factor. Low-PP Trio has highest growth-factor.

	• 1940	>>> • Compare 1960 with 1940 • <<<					>>> • Compare 1988 with 1940 • <<<				
	Col.A 1940 MortRate Tab 16-A	Col.B 1960 MortRate Tab 16-A	Col.C Ratio Col.B /Col.A	Col.D Input from Col.C	Col.E Diff: Col.B minus A	Col.F Input from Col.E	Col.G 1988 MortRate Tab 16-A	Col.H Ratio Col.G /Col.A	Col.I Input from Col.H	Col.J Diff: Col.G minus A	Col.K Input from Col.J
Pacif	12.0	34.9	2.908	Avg Chg	22.9	Avg Chg	50.7	4.225	Avg Chg	38.7	Avg Chg
NewE	13.5	38.1	2.822	TopTrio	24.6	TopTrio	56.3	4.170	TopTrio	42.8	TopTrio
MidAtl	17.1	40.6	2.374	2.702	23.5	23.7	57.5	3.363	3.919	40.4	40.6
WNoCen	7.7	28.4	3.688	Avg Chg	20.7	Avg Chg	56.2	7.299	Avg Chg	48.5	Avg Chg
ENoCen	10.6	35.7	3.368	MidTrio	25.1	MidTrio	62.3	5.877	MidTrio	51.7	MidTrio
Mtn	7.8	25.5	3.269	3.442	17.7	21.2	44.2	5.667	6.281	36.4	45.5
WSoCen	7.6	34.9	4.592	Avg Chg	27.3	Avg Chg	67.9	8.934	Avg Chg	60.3	Avg Chg
ESoCen	4.9	29.0	5.918	LowTrio	24.1	LowTrio	79.1	16.143	LowTrio	74.2	LowTrio
SoAtl	8.3	35.7	4.301	4.937	27.4	26.3	68.5	8.253	11.110	60.2	64.9

Related text = Part 5a.

The notes below apply to Box 3 above and also to every Box 1 in Chapters 49 through 65.

MR = MortRate (mortality rate). PP = PhysPop (physicians per 100,000 population).

High-PP Trio (TopTrio) = Three Census Divisions with the highest average accumulated doses from medical radiation (Table 47-A). These are Pacific, New England, Mid-Atlantic.

Low-PP Trio (LowTrio) = Three Census Divisions with the lowest average accumulated doses from medical radiation (Table 47-A). These are West South Central, East South Central, and South Atlantic.

• - Columns A, B, and G = Annual MortRates per 100,000 males, age-adjusted to the 1940 population distribution, from Table 16-A.

• - Col.C = The ratios of the 1960 MortRates divided by the 1940 MortRates. Col.H presents the ratio for 1988 MRs / 1940 MRs.

• - Col.D = The average value of Col.C, for each Trio of Census Divisions. Example: The 1960/1940 MortRate-ratios in the TopTrio Census Divisions were 2.908, 2.822, and 2.374, whose simple average is 2.702. In other words, on the average, the 1960 MortRates in the TopTrio were 2.702 times their 1940 values. The value, 2.702, is the "growth-factor" or "change-factor" for the TopTrio, 1960 vs. 1940. Col.I shows 1988 vs. 1940.

• - Col.E = The 1960 MortRates minus the 1940 MortRates. Col.E shows the difference, which is positive. Col. J compares 1988 with 1940.

• - Col.F = The average value of Col.E, for each Trio of Census Divisions. Example: The differences (1960 MR minus 1940 MR) in the TopTrio Census Divisions were 22.9, 24.6, and 23.5, whose simple average is 23.7. In other words, on the average, the 1960 MortRates in the TopTrio differed by +23.7 (per 100,000 population) from their 1940 values. Col.K compares 1988 with 1940.

Figure 48-A.
Growth of Smoking by Gender, 1890-1980, in the United Kingdom.

• Source: Chapter One of the 1983 report, "Health or Smoking? Follow-Up Report of the Royal College of Physicians of London" (Royal College 1983).

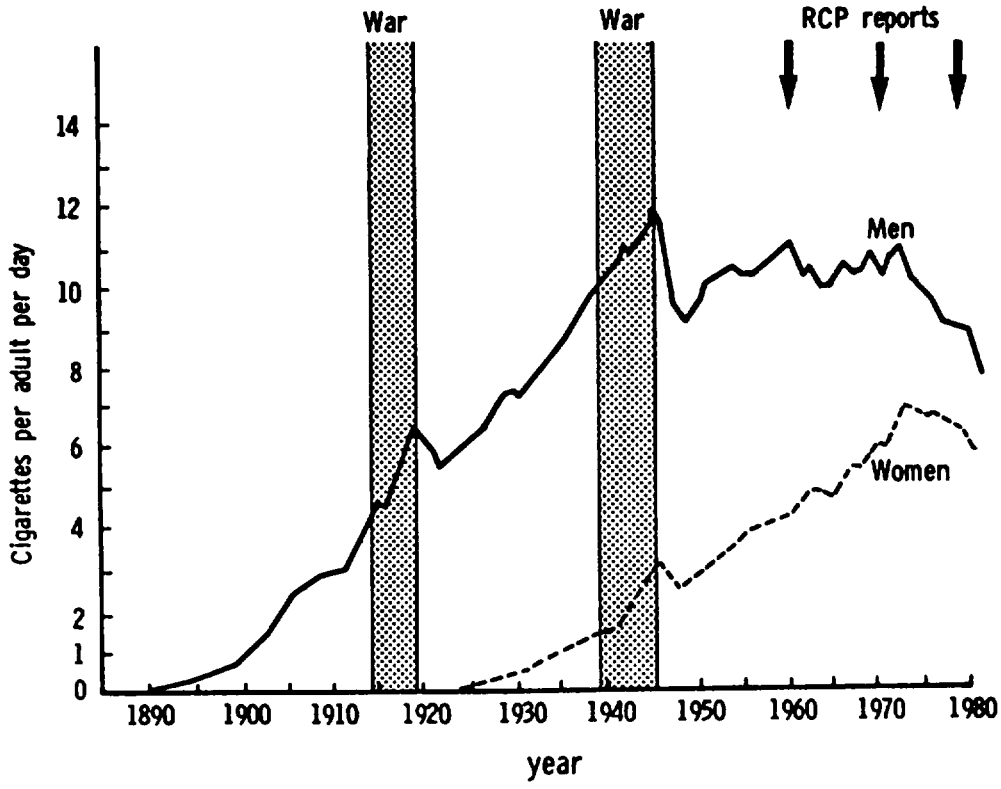


Figure 1.1. Tobacco consumption in the UK 1890 to 1981, given as average number of cigarettes per adult per day for men and women separately, irrespective of whether they smoke or not. The arrows indicate the dates of the three previous Royal College of Physicians reports. Data from Tobacco Research (now Advisory) Council [reference 1 and unpublished data reproduced with permission]

Reference 1, above, is entered as Tobacco 1976 in our Reference List.

Related text = Part 2a.

Figure 48-B.

Lung Cancer: Per Capita Cigarette-Use and Male Lung-Cancer MortRates.

- The 16 diamond-like symbols depict male lung-cancer MortRates per 100,000 population. The rates are age-adjusted to 1970 because they were calculated by the American Cancer Society. We obtained these rates off the ACS graph at page 17 of Landis 1998. Except for the years before 1930, Figure 48-B depicts rates of lung-cancer mortality and rates of per capita cigarette-consumption for the same years.

- The 22 boxy symbols depict annual use of cigarettes per capita (smokers + nonsmokers, genders combined, USA), from 1900 to 1994. Source is MMWR, Nov. 18, 1994, Vol.43, No.SS-3, pp.6-7, Table 1. Because we have a single set of values on the vertical axis, cigarette-use is depicted at 1/50 of its actual rate. Example: The boxy symbol for 1930 is at about 30 on the vertical scale. This means the rate is (30 x 50), or 1,500 cigarettes per capita per year --- in harmony with the value of 1,485 shown in the tabulation of our text, Part 2a. The list on the left shows the value of each boxy symbol.

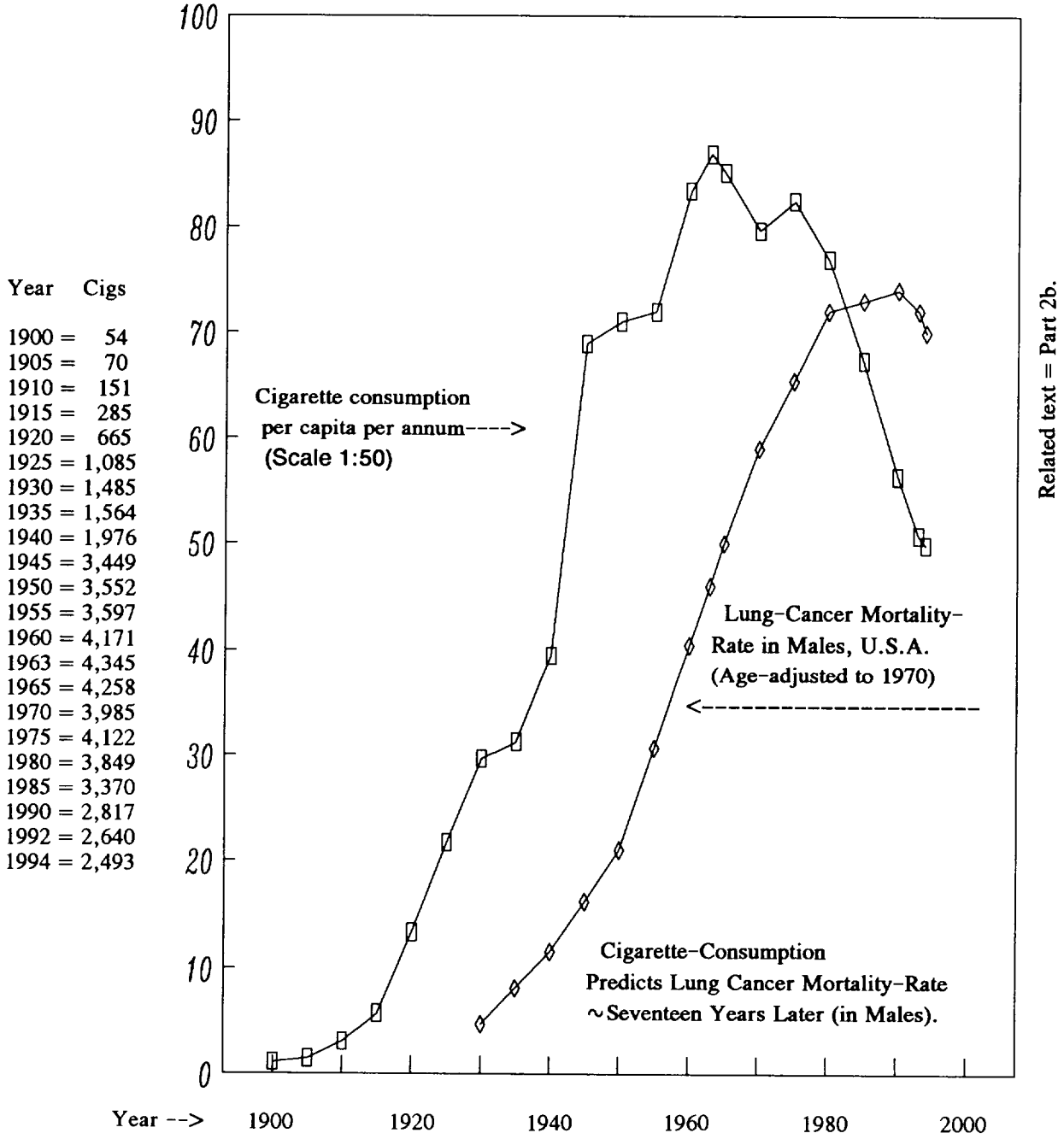


Figure 48-C.

Ischemic Heart Disease: Per Capita Cigarette-Use and Male IHD MortRates.

• The 11 cross-like symbols depict male IHD MortRates per 100,000 population, age-adjusted to 1940, for the period 1950-1994. The rates come from our Table 40-A, except for the peak year (1963).

• With no change from our Figure 48-B, the 22 boxy symbols depict annual use of cigarettes per capita (smokers + nonsmokers, genders combined, USA), from 1900 to 1994. Source is MMWR, Nov. 18, 1994, Vol.43, No.SS-3, pp.6-7, Table 1. Because we have a single set of values on the vertical axis, cigarette-use is depicted at 1/10 of its actual rate. Example: The boxy symbol for 1930 is at about 150 on the vertical scale. This means the rate is (150 x 10), or 1,500 cigarettes per capita per year — in harmony with the value of 1,485 shown in the tabulation of our text, Part 2a. The list on the left shows the value of each boxy symbol.

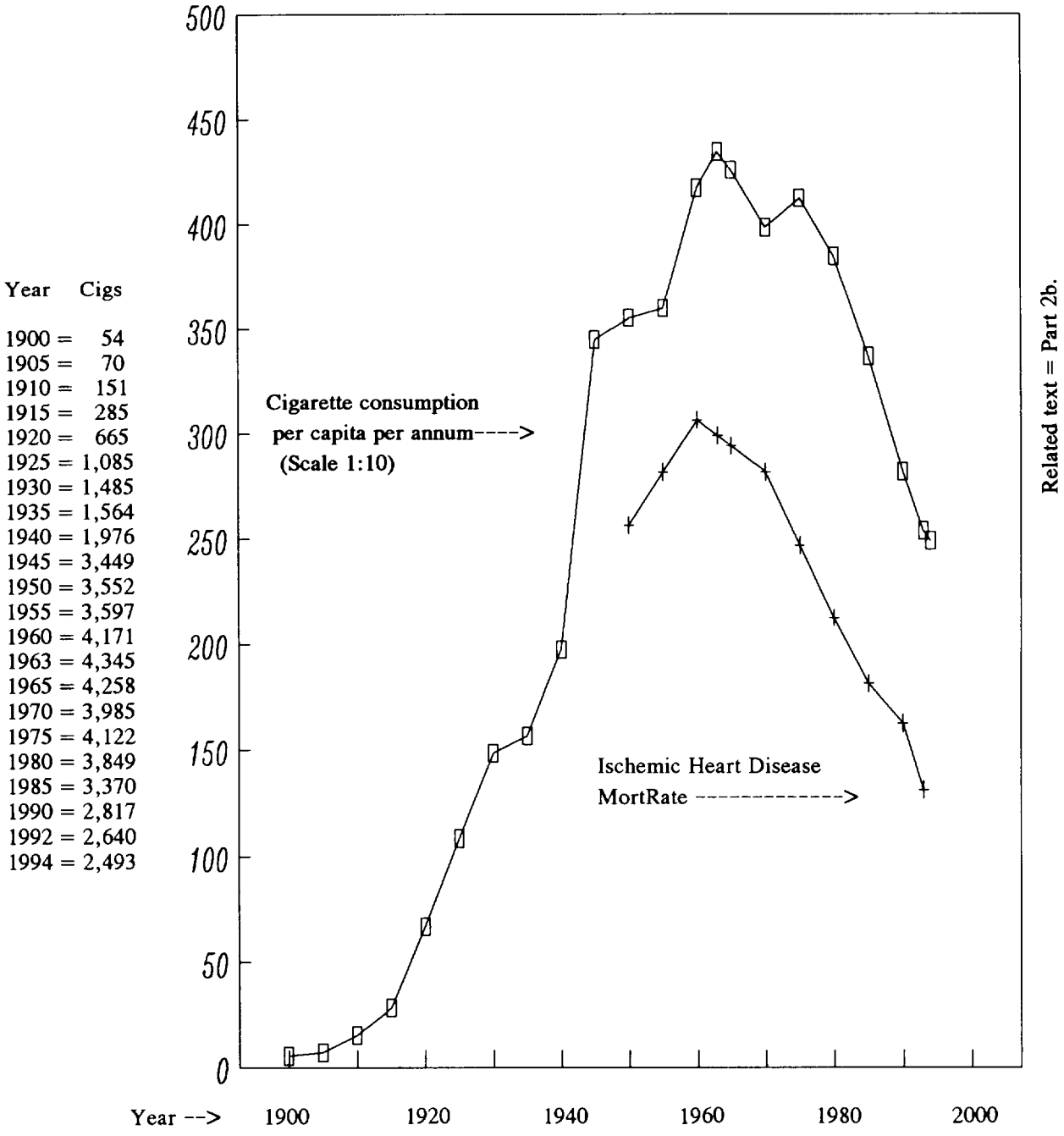
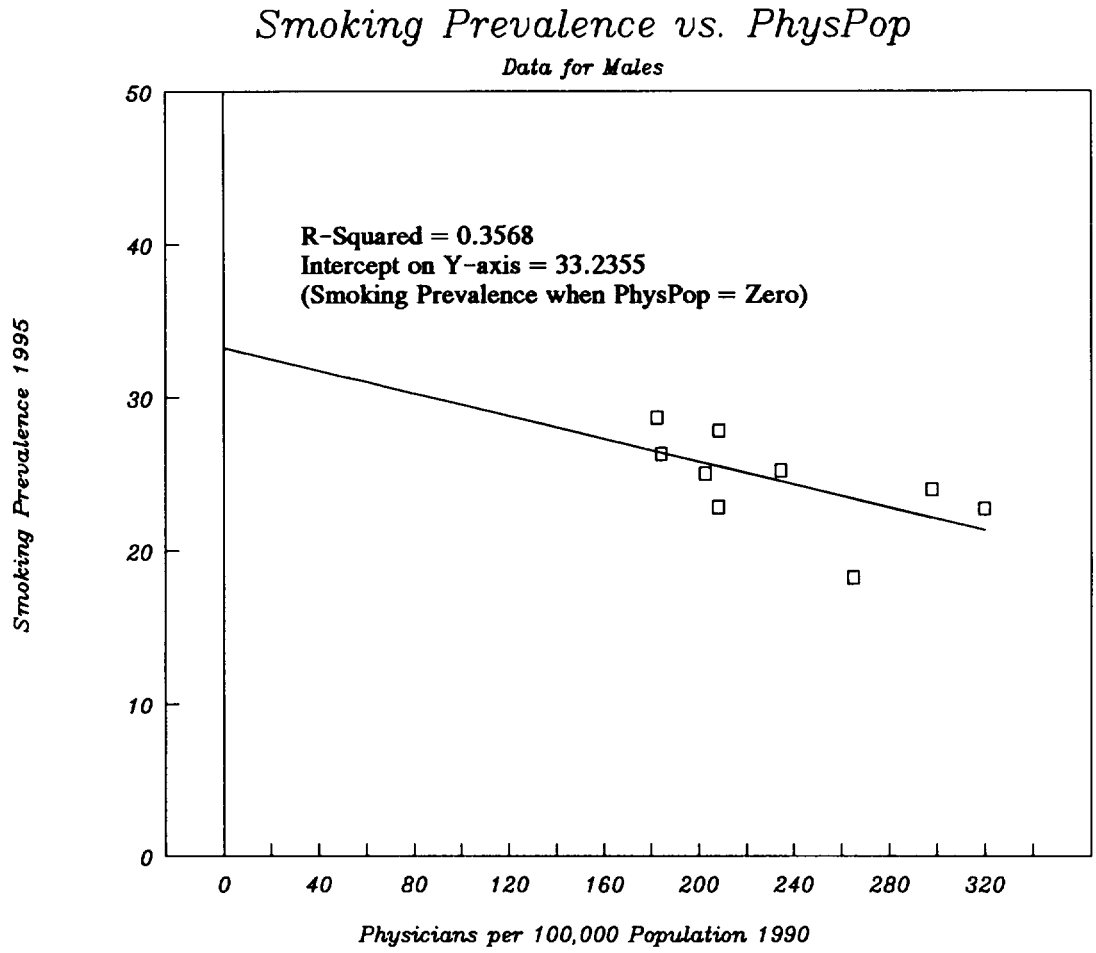


Figure 48–D

Inverse Relationship: Male Smoking Prevalence 1995, Regressed on PhysPop 1990.

o Source: Male 1995 smoking prevalence, by Census Divisions, was calculated by us from the state–by–state data provided in CDC's Morbidity and Mortality Weekly Report (MMWR) Vol. 45, No. 44, Nov. 8, 1996. The PhysPop Values come from our own Universal PhysPop Table 3–A.



Census Divisions	Males PhysPop 1990	Males SmokPrev 1995
Pacific	265.09	18.24
New England	319.88	22.71
West North Central	202.78	24.97
Midatlantic	297.79	23.96
East North Central	208.54	27.81
Mountain	208.20	22.82
West South Central	184.34	26.29
East South Central	182.42	28.63
South Atlantic	234.48	25.18

Regression Output:

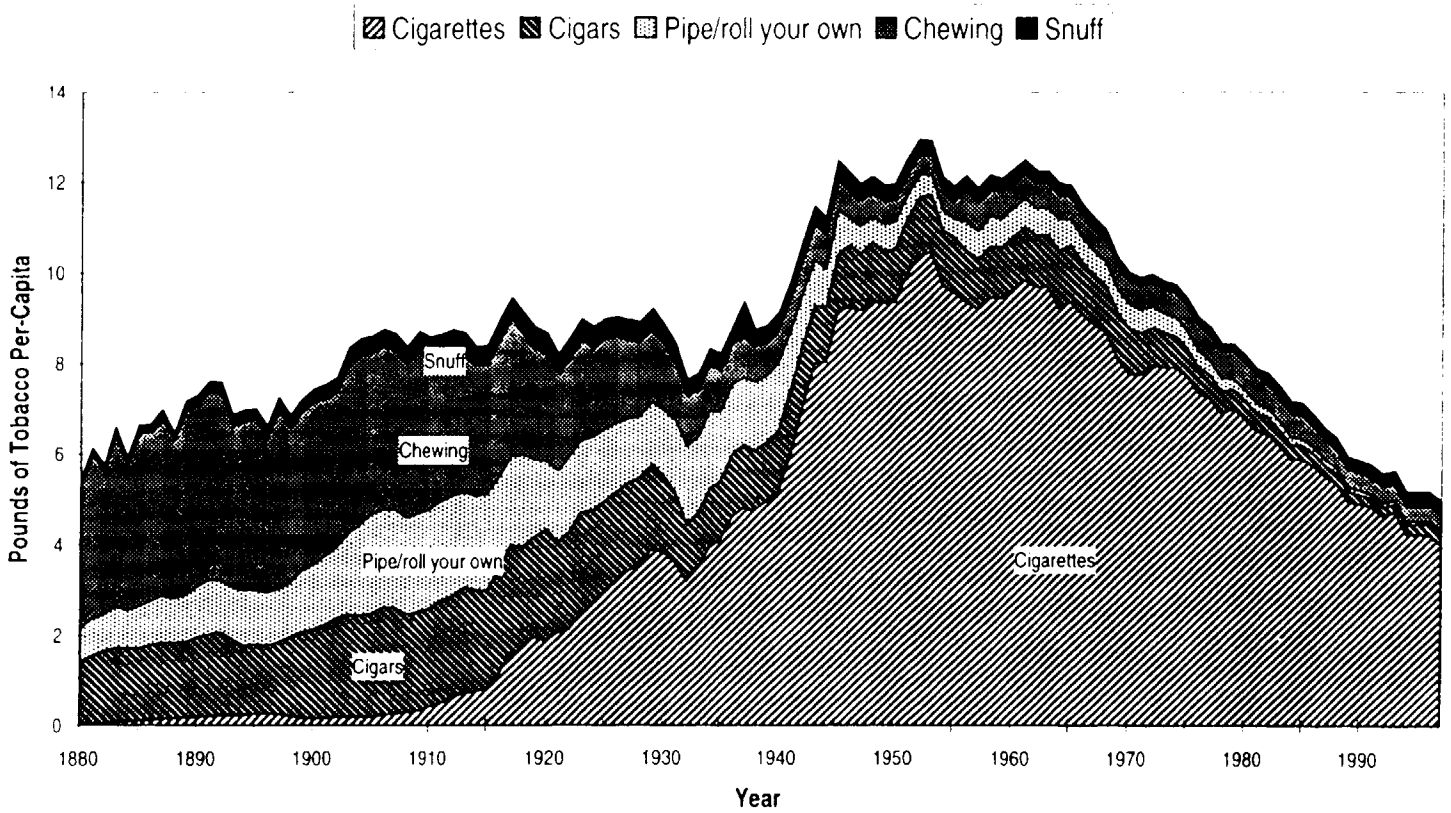
Constant	33.2355
Std Err of Y Est	2.6669
R Squared	0.3568
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	–0.0373
Std Err of Coef.	0.0189
Coeff. / S.E.	–1.9705

Equation of Best Fit: (–0.0373) * (PhysPop) + 33.2355

Related text = Part 4a.

Figure 48-E

Per-Capita Consumption of Different Forms of Tobacco in the USA, 1880-1997.



The figure above, and its title, are reproduced from a publication of the National Cancer Institute (NCI 1998, p.22, Figure 1) entitled Cigars: Health Effects and Trends --- Monograph 9 on Smoking and Tobacco Control.

Related text = Part 2a.