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TOBACCO SMOKING AND LONGEVITY

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Under this same title Raymond Pearl published a short note a quarter century ago.¹ As I do not find this reference in the recent report on *Smoking and Health*, I wish to make some comments upon it. The method used by Pearl is that of the life table, not that of mortality ratios. In Table 1, I give some of his figures for nonusers and for smokers with the addition of the expectation of life² and the mortality ratios at the different ages, and more material from other studies.

Pearl did not state his definition of heavy smokers, nor specify what they smoked; this makes detailed comparison with recent studies impossible. The striking thing about his figures is the high mortality ratios at ages 30–45 and the consequent great shortening of life expectancy. Are such high ratios for the younger smokers real or only statistical artifacts? There is no way to give a definitive answer to this question because different authors with different populations and with different methods fail to put their data in sufficiently comparable form so that the proper comparisons can be made. This is too bad, for if the data were in comparable form and the high mortality ratios turned out to be real, a careful study of the young deaths, even though relatively few, might be more illuminating than the study of the run-of-the-mill cases in the age range of maximum incidence and relatively low mortality ratios.

Comments.—Pearl's mortality ratios (col. 4) for moderate smokers maximize at ages 45–50; for heavy smokers, at 35–40. (They are taken to be the ratios of the probabilities q_x , which for ages from 30 to 80 differ little from mortality ratios.) Dorn's figures (col. 8) are calculated from the first two lines of his Table 4 in which he had 1179 deaths of nonsmokers and 6203 of tobacco users distributed by ages.³ There is in the age group 30–39 a mortality ratio 1.9, whereas in the 40–49 group it is only 1.1 but rises to 1.47 at 55–60. This behavior is different from that in columns (4) or (5) and may well be due to small numbers. But in column (9), which gives Hammond's new figures⁴ for smokers of cigarettes only, the mortality ratios are higher than for Pearl's heavy smokers. Next are the results read from the graphs of Ipsen and Pfaelzer⁵ which compare smokers of cigarettes only with nonsmokers as do Hammond's figures. The youngest group with figures available is aged 45–50, and here they are similar to Hammond's; if it were permissible to follow the fitted straight line back to earlier ages, the ratios

TABLE 1
QUASI-COMPARABLE MORTALITY RATIOS—SMOKERS VERSUS NONSMOKERS

Key to Columns: (0) is age. (1), (2), and (3) are, respectively, Pearl's 100,000 q_x (mortality probabilities), for non-smokers, moderate smokers, and heavy smokers. (4) and (5) are mortality ratios for moderate smokers and heavy smokers, respectively. (6) and (7) are expectations of life. (8) gives Dorn's mortality ratios centered at the centers of his age intervals. (9) gives Hammond's mortality ratios for his new study for smokers of cigarettes only. (10a) and (10b) give the mortality ratios for Ipsen and Pfaelzer's study of U.S. veterans as well as I can read them from their straight-line logarithmic chart and from the distances between the heavy dots to which the lines were fitted. (11) gives the expectation of life of U.S. white males in the Registration States of 1919-1921. n.d. means no data.

(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10a)	(10b)	(11)
30	818	786	1689	0.90	2.06	36.1	28.7					37.6
35	878	963	2127	1.07	2.42	32.5	26.3	1.9	n.d.	2.7	n.d.	33.7
40	1001	1189	2391	1.19	2.39	28.7	24.2			2.4	n.d.	29.9
45	1204	1480	2569	1.23	2.13	25.1	22.1	1.1	2.33	2.2	n.d.	26.0
50	1516	1861	2749	1.23	1.81	22.0	19.9			2.1	2.1	22.2
55	1982	2367	3009	1.19	1.52	18.7	17.6	1.3	2.06	2.0	2.3	18.6
60	2673	3049	3429	1.14	1.28	15.7	15.2	1.47		1.9	1.9	15.2
65	3688	3983	4120	1.08	1.12	12.9	12.8	1.28	1.70	1.8	1.8	12.2
70	5169	5284	5272	1.02	1.02	10.4	10.5	1.30		1.7	1.8	9.5
75	7302	7128	7233	0.98	0.99	8.3	8.4	1.08	1.47	1.6	1.7	7.3
80	10,322	9795	10,044	0.95	0.97	6.6	6.7	1.05		1.5	1.3	5.5

would be even higher as in column (10a). Column (11) is added only for its comparison with columns (6) and (7).

It seems that the evidence is strong that a careful study of smokers and non-smokers in the age range of 25-40 should be made.

¹ Pearl, R., *Science*, **87**, 216-217 (1938). This was stated as no. VII in his series of "Studies in Human Longevity." No. VIII on "Bodily Constitution and Human Longevity" appeared in these PROCEEDINGS, **25**, 609-616 (1939). He had long worked in the field of longevity; in the note on tobacco, he mentioned as other habitual dietary items "not physiologically necessary," tea, coffee, alcohol, opium, and betel nut, in one or another part of the world, and he had worked a good deal on alcohol.

² The expectations of life were calculated from Pearl's figures for l_x (omitted from Table 1) by the usual trapezoidal rule which distributes the deaths in each interval uniformly over it. For operating with age intervals of five or more years, see the discussion by C. R. Doering and A. L. Forbes, these PROCEEDINGS, **24**, 400-405 (1938).

³ Dorn, H. F., *Proc. Social Statist. Sect. Amer. Statist. Assoc.* (1958), pp. 34-71; in the Surgeon General's Report, *Smoking and Health*, it is stated on page 83 that for Dorn's study 24,519 deaths in 1,312,000 person-years of exposure had been accumulated; it is too bad I could not find a table analogous to Dorn's Table 4 in the Report so that column (8) could be given up-to-date figures.

⁴ Hammond, E. C., in *Smoking and Health*, U.S. Public Health Service Pub. no. 1103 (1964), p. 87, last line. *Added in proof:* More complete data have just been given by Hammond in *J. Natl. Cancer Inst.*, **32**, 1161-1189 (1964).

⁵ Ipsen, J., and A. I. Pfaelzer, in *Smoking and Health*, U.S. Public Health Service Pub. no. 1103 (1964), p. 88. Naturally I should have preferred figures to graphs, and raw figures as well as those obtained by mathematical manipulations: many age-specific death rates fail to plot straight on arithlog paper, even from 40 to 80, and for my present purposes I would not force them to.