A study of some 200,000 life insurance policyholders contributes striking evidence that regular cigarette smokers are subject to increased risk of dying from lung cancer, as well as cardiovascular disease, certain respiratory diseases, ulcers, and cirrhosis of the liver.

Tobacco Consumption and Mortality From Cancer and Other Diseases

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IN 1954 the Public Health Service in cooperation with the Veterans Administration initiated a study of the causes of death among policyholders of U.S. Government life insurance. This insurance was available only to persons who served in the Armed Forces of the United States between 1917 and 1940. Although most of the policyholders were veterans of World War I, an appreciable number first served after that date. All except less than 0.5 percent of the policyholders included in this study were men.

Method of Study

Beginning in January 1954, a questionnaire requesting information concerning the use of tobacco, usual occupation, and industry was mailed to each policyholder. Usable replies were received from 198,926 persons, or 68 percent of those included in the original mailing. A second questionnaire was mailed to nonrespondents beginning in January 1957. Usable replies were received from an additional 50,000 policyholders, making a total of approximately 249,000, or 85 percent of the number included in the study, for whom information concerning the use of tobacco, occupation,

and residence is available. The nonrespondents have been retained in the study, and the same medical information is available for them as for the respondents.

Whenever a claim is filed for the payment of a policy, the Veterans Administration forwards a copy of the death notice, usually a copy of the official death certificate, to the Public Health Service. Additional medical information, including verification of the causes of death

Definitions

SMOKING HISTORY

Persons were classified by smoking history in accordance with the following definitions.

Used tobacco: Persons who had smoked at least 5 to 10 packs of cigarettes or 50 to 75 cigars or 3 to 5 packages of pipe tobacco.

Smoked occasionally only: Persons who had never regularly smoked any form of tobacco but who had occasionally smoked one or more forms. Also included here were persons with unknown amount used either currently or in the past, provided that the maximum amount of known use was occasional only.

Regular smoker: Persons who at sometime during their lifetime had regularly smoked cigars, cigarettes, or pipe tobacco. These were further classified by the form of tobacco used and whether or not they were smoking at the start of the study in 1954.

Regular smoker, cigarettes only: Persons who had regularly smoked only cigarettes. They may have occasionally smoked cigars or a pipe, but they had never smoked either of these regularly.

Regular smoker, cigarette and cigar: Persons who had regularly smoked both cigarettes and cigars. They may have smoked a pipe occasionally but never regularly. Similar definitions were used for regular smokers of other combinations of tobacco.

Amount unknown: Persons who stated they had smoked more than the minimum amount to qualify as a user of tobacco but who did not report the amount used either currently or in the past with sufficient accuracy to permit assignment to one of the groups of regular or occasional smokers.

Amount used: In this report, classification by amount of tobacco used is based on the current amount used at the time the questionnaire was filled out in 1954. Regular smokers of (*a*) cigarettes and cigars, (*b*) cigarettes and pipe, and (*c*) cigarettes, cigars, and pipe were classified by the current number of cigarettes smoked. Regular users of cigars and pipes were classified by the current number of cigars smoked.

CAUSE OF DEATH

The broad groups of causes of death used in this study (table 4 and fig. 5) include the following categories of the International Statistical Classification of Diseases, Injuries, and Causes of Death (seventh revision, 1955):

Cancer of lung: 162, 163.
Cancer except lung: 140–205, except 162, 163.
Respiratory diseases:
   Respiratory tuberculosis: 001–008.
   Asthma: 241.
   Influenza and pneumonia: 480–493.
   Bronchitis: 500–502.
   Emphysema without bronchitis: 527.1.
   Other respiratory diseases: 470–475; 527.0; 527.2; 510–526.
Accidents:
   Motor vehicle accidents: 810–835.
   Other accidents: 800–802; 840–962; 980–991.
Suicide: 970–979.
Cardiovascular diseases:
   Cerebral vascular lesions: 330–334.
   Rheumatic fever: 400–402.
   Chronic rheumatic heart disease: 410–416.
   Arteriosclerotic heart disease: 420.
   Nonrheumatic chronic endocarditis: 421–422.
   Other heart disease: 430–434.
   Hypertension with mention of heart disease: 440–443.
   Hypertension without mention of heart disease: 444–447.
   General arteriosclerosis: 450.
   Other circulatory system disease: 451–468.
   Chronic nephritis: 592–594.
Other diseases: Remaining categories.

entered on the death certificate, the procedures used to establish these diagnoses, whether the deceased had cancer even though it was not considered to be an underlying or contributory cause of death, and the histological type of cancer, is requested from the physician who signed the death certificate or from the hospital where the death occurred.

Verification of the cause of death is not requested whenever the death occurs outside the United States, is due to an accident, or is certified by a coroner. Replies have been received to more than 99 percent of the letters of inquiry.

The underlying cause of death was changed for 6 percent of the deaths for which a comparison could be made between the entry on the official death certificate and the subsequent in-

formation received in response to the letters of inquiry. Additional diseases contributory to death were reported for another 12 percent of the deaths, although the underlying cause was unchanged.

An autopsy had been made in nearly one-third (31 percent) of the deaths for which information concerning method of diagnosis was obtained. For about one-half of the deaths (47 percent) the diagnoses were established by exploratory surgery, endoscopy, radiography, or various laboratory tests. The diagnoses of the remaining one-fifth (22 percent) of the deaths were based upon physical examination and clinical history.

Basis of This Report

This report is based on deaths occurring during the 2½-year period July 1954–December 1956 among persons for whom information concerning use of tobacco was obtained prior to July 1954. Deaths during the first 6 months of 1954 have been excluded since the original questionnaire about the use of tobacco was mailed during this period. In addition to persons who died before they received a questionnaire, replies were not received from some persons who were seriously ill when the questionnaire was received; any deaths among these persons were

Figure 1. Mortality of smokers and nonsmokers; ratio of observed to expected number of deaths.
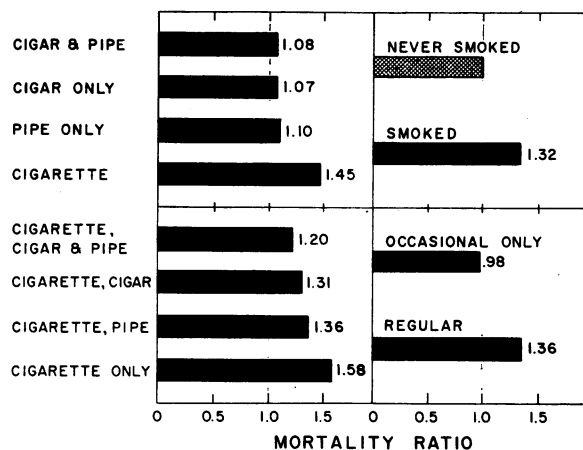
assigned to the group of nonrespondents. Although the death rate of the entire group of policyholders was not changed by this exclusion, the rates for both the nonrespondents and the respondents were biased since a disproportionate number of deaths had to be assigned to the nonrespondent group. Inspection of the data revealed that the effect of this bias had largely disappeared by July 1954.

The following data are based on 478,952 person-years exposure, of which 89,774 were contributed by persons who had never smoked

Table 1. Mortality of smokers and nonsmokers: Ratio of observed to expected number of deaths (all causes), by smoking history and current use, July 1954–December 1956

| Smoking history	Number of person-years exposure	Current use		
		Total	Smokes	Does not smoke
Never smoked	89, 774	1. 00		
Used tobacco	389, 178	1. 32	1. 37	1. 24
Occasionally only	28, 144	. 98	. 91	1. 05
Regular smoker	339, 903	1. 36	1. 40	1. 30
Cigarette total	271, 757	1. 45	1. 54	1. 30
Cigarette only	161, 172	1. 58	1. 65	1. 39
Cigarette and other	110, 585	1. 29	1. 35	1. 21
Cigarette and cigar	21, 188	1. 31	1. 34	1. 27
Cigarette and pipe	53, 168	1. 36	1. 41	1. 26
Cigarette, cigar, pipe	36, 229	1. 20	1. 28	1. 11
Cigar only	28, 422	1. 07	. 94	1. 44
Cigar and pipe	21, 944	1. 08	1. 04	1. 21
Pipe only	17, 780	1. 10	1. 05	1. 25
Amount unknown	21, 131	1. 06	1. 43	1. 05

NOTE: Expected number of deaths computed by multiplying the number of person-years exposure in each age group for each smoking history category by the age-specific death rates of persons who had never smoked.

and 389,178 by persons who had smoked tobacco in some form during their lifetime. The number of person-years exposure of persons classified by type of smoking history is shown in table 1.

Unless otherwise specified, the death rate for smokers is expressed as a ratio to that for persons who have never smoked. This mortality ratio is calculated by dividing the number of observed deaths for each smoking history group by the number of expected deaths based on the age-specific death rates of persons who have never smoked. The ratio of 1.32 shown in table 1 for persons who have smoked tobacco at some time means that the death rate for these persons from all causes combined is 32 percent greater than the rate for persons who have never smoked.

The mortality ratio as used here is a measure of the relative excess mortality of smokers compared with nonsmokers. An equally valid measure would be the absolute difference between the observed and the expected number of deaths. The total number of excess deaths, if any, may be apportioned among the various individual causes of death, thus ranking the causes according to the proportion of the total excess number of deaths for which they are responsible. These two measures are designed to emphasize different aspects of the variation in mortality between two groups. The main interest in this paper is the relative difference

Figure 2. Death rate of regular smokers and nonsmokers by age and type of tobacco used.
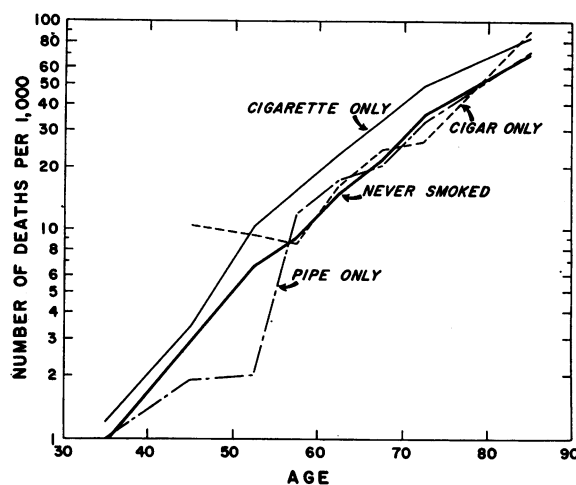
in the death rate of smokers and nonsmokers; therefore, the mortality ratio will be used exclusively.

Mortality by Type of Smoking

The largest increase in mortality among persons who have smoked is found for those who have regularly smoked only cigarettes (fig. 1). The death rate for these smokers is 58 percent greater than that for nonsmokers. Persons who have smoked regularly only cigars, only a pipe, or cigars and a pipe die at a rate

Table 2. Mortality by age among smokers and nonsmokers: Number of deaths per 1,000 per year, by smoking history and age, July 1954–December 1956

Smoking history	Number of deaths	Death rate per 1,000								
		All ages	30–39	40–49	50–54	55–59	60–64	65–69	70–74	75 and over
Never smoked	1,179	13.1	0.7	2.9	6.6	9.0	14.8	21.6	35.8	70.0
Used tobacco	6,203	15.9	1.3	3.2	9.3	13.1	19.0	28.1	38.6	73.3
Occasionally only	345	12.3	2.0	2.7	3.2	9.5	12.9	23.6	30.6	85.2
Regular smoker	5,564	16.4	1.3	3.4	9.8	13.6	19.8	28.9	39.6	72.6
Cigarette total	4,513	16.6	1.4	3.3	10.4	14.4	20.9	31.2	43.5	72.8
Cigarette only	2,771	17.2	1.2	3.4	10.4	15.3	22.9	33.4	49.8	84.7
Cigarette and other	1,742	15.8	1.8	3.1	10.4	13.0	18.1	28.8	37.4	62.9
Cigarette and cigar	363	17.1	3.0	7.4	10.2	10.5	17.8	37.0	43.6	48.2
Cigarette and pipe	805	15.1	1.4	2.0	10.1	14.1	19.3	28.3	34.9	73.5
Cigarette, cigar, pipe	574	15.8	2.2	4.5	11.0	12.8	16.7	24.5	36.3	62.5
Cigar only	433	15.2	.0	10.4	9.3	8.5	16.3	24.1	26.7	89.6
Cigar and pipe	342	15.6	.0	2.3	7.3	11.1	15.8	23.5	34.6	56.5
Pipe only	276	15.5	1.0	1.9	2.0	11.8	17.2	20.6	32.4	71.7
Amount unknown	294	13.9	.7	.0	7.8	10.2	15.6	22.9	33.8	67.8

Table 3. Mortality of regular smokers by current amount smoked: Ratio of observed to expected number of deaths (all causes), by smoking history and current amount smoked in 1954, July 1954–December 1956

Smoking history	Ratio of observed to expected deaths					Number of observed deaths				
	Current number of cigarettes smoked per day									
	Occasional	Less than 10	10–20	21–39	40 or more	Occasional	Less than 10	10–20	21–39	40 or more
Cigarette only_____	0.96	1.29	1.66	1.77	1.99	25	205	1,019	663	137
Cigarette and other_____	1.08	.95	1.37	1.72	1.79	72	159	492	319	59
Cigarette and cigar_____	1.08	.90	1.30	1.75	2.71	13	35	91	56	19
Cigarette and pipe_____	1.00	1.03	1.36	1.88	1.40	27	71	252	180	21
Cigarette, cigar, pipe_____	1.14	.88	1.41	1.46	1.73	32	53	149	83	19
	Current number of cigars smoked per day									
	Occasional	1–2	3–4	5–8	9 or more	Occasional	1–2	3–4	5–8	9 or more
Cigar only_____	1.05	0.71	1.00	0.99	1.44	20	62	97	79	26
Cigar and pipe_____	.93	1.16	.99	.87	1.33	40	101	67	32	8
	Current number of pipefuls smoked per day									
	Occasional	Less than 5	5–9	10–19	20 or more	Occasional	Less than 5	5–9	10–19	20 or more
Pipe only_____	0.86	0.96	1.12	0.98	1.21	6	44	73	45	29

NOTE: Expected number of deaths computed by multiplying the number of person-years exposure in each age group for each smoking history category by the age-specific death rates of persons who had never smoked.

only slightly in excess of that for nonsmokers. Individuals with a history of regularly smoking cigars or a pipe, or both, in addition to cigarettes are subject to a mortality rate definitely greater than that for nonsmokers but less than the rate for persons who have smoked regularly only cigarettes. Occasional smoking, irrespective of the form of tobacco used, apparently has no effect upon the total death rate.

On January 1, 1954, the policyholders included in this study varied in age from 30 years to more than 80 years. The vast majority, 84 percent, were between 50 and 70 years of age; only 2 percent were more than 70 years old.

The age-specific death rates presented in table 2 and figure 2 show the same relationship between the death rate from all causes and smoking history as the average rates for all ages combined given in table 1. The relative amount of the excess mortality of regular smokers in comparison with that of nonsmokers decreases after age 70, but this finding cannot be regarded as firmly established because of the small number of persons who were more than 70 years old at the start of the study.

Mortality of Ex-Smokers

Regular cigarette users who had stopped smoking prior to the start of the study in 1954 have a lower death rate than persons who continued to smoke (table 1). Nevertheless their death rate on the average still exceeds that for nonsmokers by 30 percent. The largest absolute decrease in the mortality ratio is found for ex-smokers who have regularly smoked cigarettes only; their mortality ratio is 1.39 com-

pared with 1.65 for persons who were still smoking cigarettes.

The much higher mortality among men who have smoked regularly only cigarettes is emphasized by the fact that the mortality ratio for those who have stopped smoking, 1.39, is slightly greater than the ratio, 1.35, for persons who were continuing to smoke cigarettes in combination with cigars or a pipe. Part of the difference in the death rates for these two groups of cigarette smokers is accounted for by the fact that persons who regularly smoke cigars or a pipe as well as cigarettes smoke fewer cigarettes per day, on the average, than do persons who regularly smoke only cigarettes. After adjusting for differences in age and average number of cigarettes currently smoked, the death rate from all causes combined for cigarette-only smokers is 14 percent greater than

that for persons who smoke cigars or a pipe in addition to cigarettes.

In contrast to cigarette smokers, ex-smokers of cigars and pipes are subject to a higher death rate than persons who continue to smoke these forms of tobacco. The death rate of those who were still regularly smoking cigars or a pipe in early 1954 does not differ significantly from that of persons who had never smoked, whereas the corresponding rate for ex-smokers ranged from 21 to 44 percent higher. This finding suggests that many of these ex-smokers may have stopped smoking because of ill health.

Whether or not this ill health may have been related to the use of tobacco is unknown.

Mortality by Current Amount Smoked

Two indexes of the amount of tobacco smoked are available for the persons included in this

Figure 3. Mortality of regular smokers by current amount smoked in 1954 and type of tobacco used; ratio of observed to expected number of deaths.
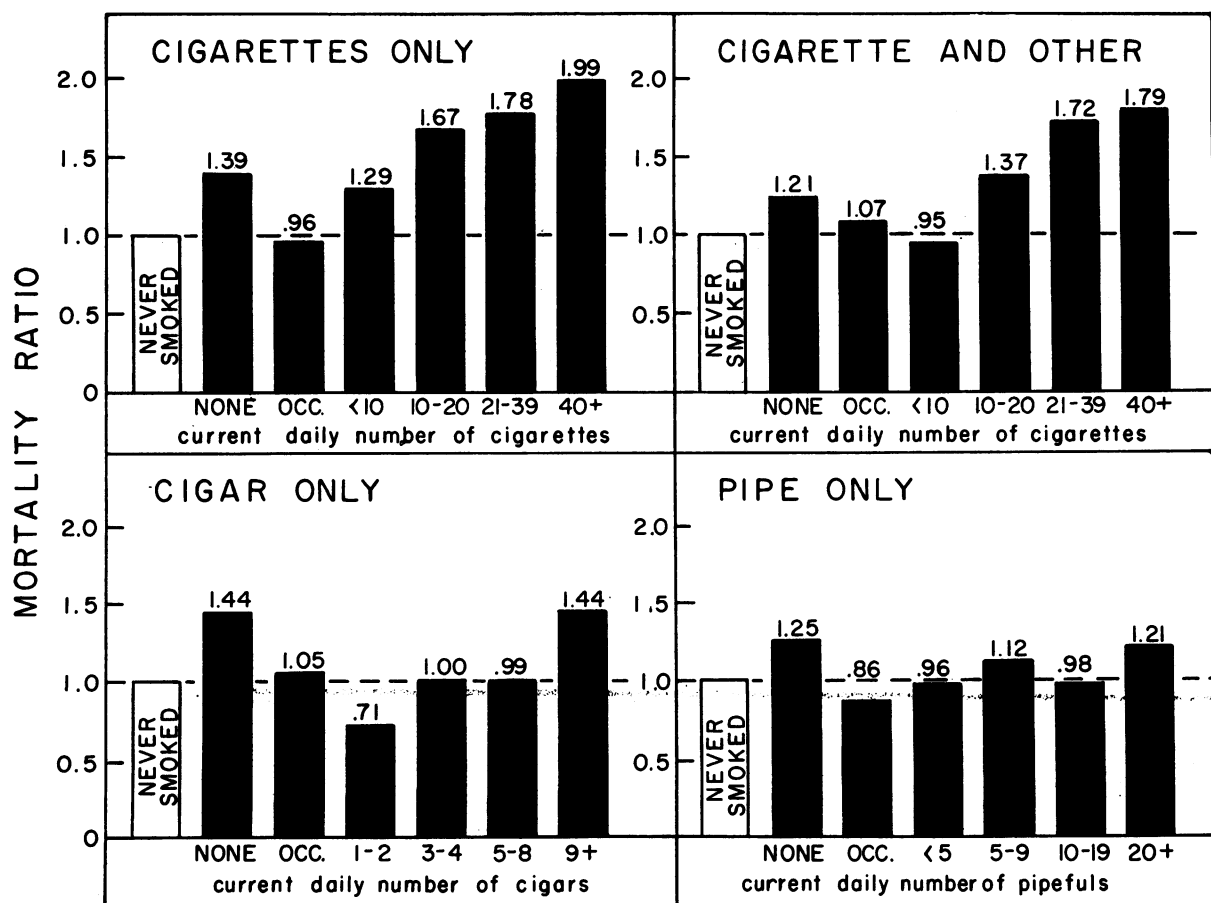
Table 4. Mortality of smokers from broad groups of causes: Ratio of observed to expected number of deaths, by smoking history and causes,[1] July 1954–December 1956.

Smoking history	Ratio of observed to expected deaths [2]						Number of observed deaths					
	Cancer of lung	Cancer, except lung	Respiratory diseases	Cardiovascular diseases	Suicide, accidents	Other diseases	Cancer of lung	Cancer, except lung	Respiratory diseases	Cardiovascular diseases	Suicide, accidents	Other diseases
Never smoked or smoked occasionally only	1.00	1.00	1.00	1.00	1.00	1.00	17	248	24	1,017	97	121
Used tobacco	6.00	1.26	1.66	1.27	.92	1.38	312	981	118	3,983	294	515
Regular smoker	6.64	1.30	1.80	1.31	.94	1.41	299	877	112	3,556	261	458
Cigarette total	8.32	1.30	2.24	1.40	.91	1.48	283	675	101	2,887	203	363
Cigarette only	9.35	1.30	2.76	1.53	.99	1.57	187	385	69	1,780	131	218
Cigarette and other	6.40	1.31	1.52	1.24	.79	1.36	96	290	32	1,107	72	145
Cigarette and cigar	7.00	1.42	1.00	1.23	.94	1.41	21	64	4	227	16	31
Cigarette and pipe	6.29	1.22	2.25	1.32	.75	1.49	44	122	18	518	33	70
Cigarette, cigar, pipe	6.20	1.35	1.25	1.14	.79	1.16	31	104	10	362	23	44
Cigar only	1.50	1.36	.43	1.00	.92	1.38	6	87	3	271	22	44
Cigar and pipe	2.00	1.48	.40	1.00	1.11	1.12	6	74	2	211	20	29
Pipe only	1.33	1.03	1.50	1.11	1.07	1.10	4	41	6	187	16	22
Amount unknown	2.00	1.00	.75	1.06	.71	1.45	6	45	3	196	12	32

[1] Underlying causes only.
[2] Expected number of deaths computed by multiplying the number of person-years exposure in each age group for each smoking history category by the age-specific death rates from each cause of death of persons who had never smoked or who had used tobacco only occasionally.

study: (a) the maximum amount ever regularly smoked, and (b) the amount currently smoked in early 1954. Table 3 and figure 3 present mortality ratios for persons currently smoking specified quantities of tobacco in 1954. All of these had smoked regularly at some time, even those smoking only occasionally at the time they completed the questionnaire.

The excess mortality of cigarette smokers is directly related to the average daily number of cigarettes smoked. Those who smoke two packs or more a day have the highest death rate—a rate averaging nearly twice that for nonsmokers. The death rates by age and current amount smoked for regular cigarette users presented in figure 4 show the same direct relationship with the average daily number of cigarettes smoked as do the rates for all ages combined in figure 3.

Only very heavy cigar or pipe smokers experience a higher mortality than nonsmokers. The death rates for the heaviest cigar or pipe smokers, those currently smoking 9 or more cigars or 20 or more pipefuls per day, are about

the same as the rate of persons who smoke from one-half to one pack of cigarettes per day. Among these smokers the mortality ratio is sig-

Figure 4. Death rate of nonsmokers and regular cigarette smokers by age and current amount smoked in 1954.
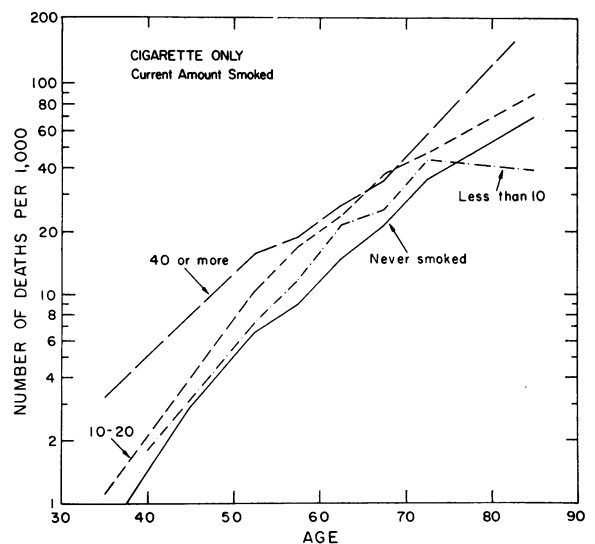
nificantly greater than one only for persons who regularly smoke cigars only and for the total of the three cigar- and pipe-smoking groups. These data lead to the conclusion that cigar or pipe smoking does not increase the total mortality rate unless large amounts of these forms of tobacco are consumed.

Classification of Deaths

Causes of death were classified according to the rules of the International Statistical Classification of Diseases, Injuries, and Causes of Death published by the World Health Organization. One underlying and a maximum of two contributory causes of death were coded. The selection of the underlying cause of death was based on the opinion of the deceased's physician except when it was obvious that the physician had misunderstood the intent of the question and had selected a terminal condition such as pulmonary failure or edema as the underlying cause. In addition, a separate code was provided for cases with cancer which the physician stated was not a contributory or underlying cause of death.

The mortality ratios for broad groups of causes (table 4, fig. 5) are based on the underlying cause of death; hence there is only one cause for each death. The mortality ratios for the specific causes of death (figs. 6 and 7, table 5) were computed from both underlying and contributory causes, and for cancer they also in-

Figure 5. Mortality of smokers from broad groups of causes of death; ratio of observed to expected number of deaths; death rate of nonsmokers and persons who have smoked only occasionally equals 1.00.
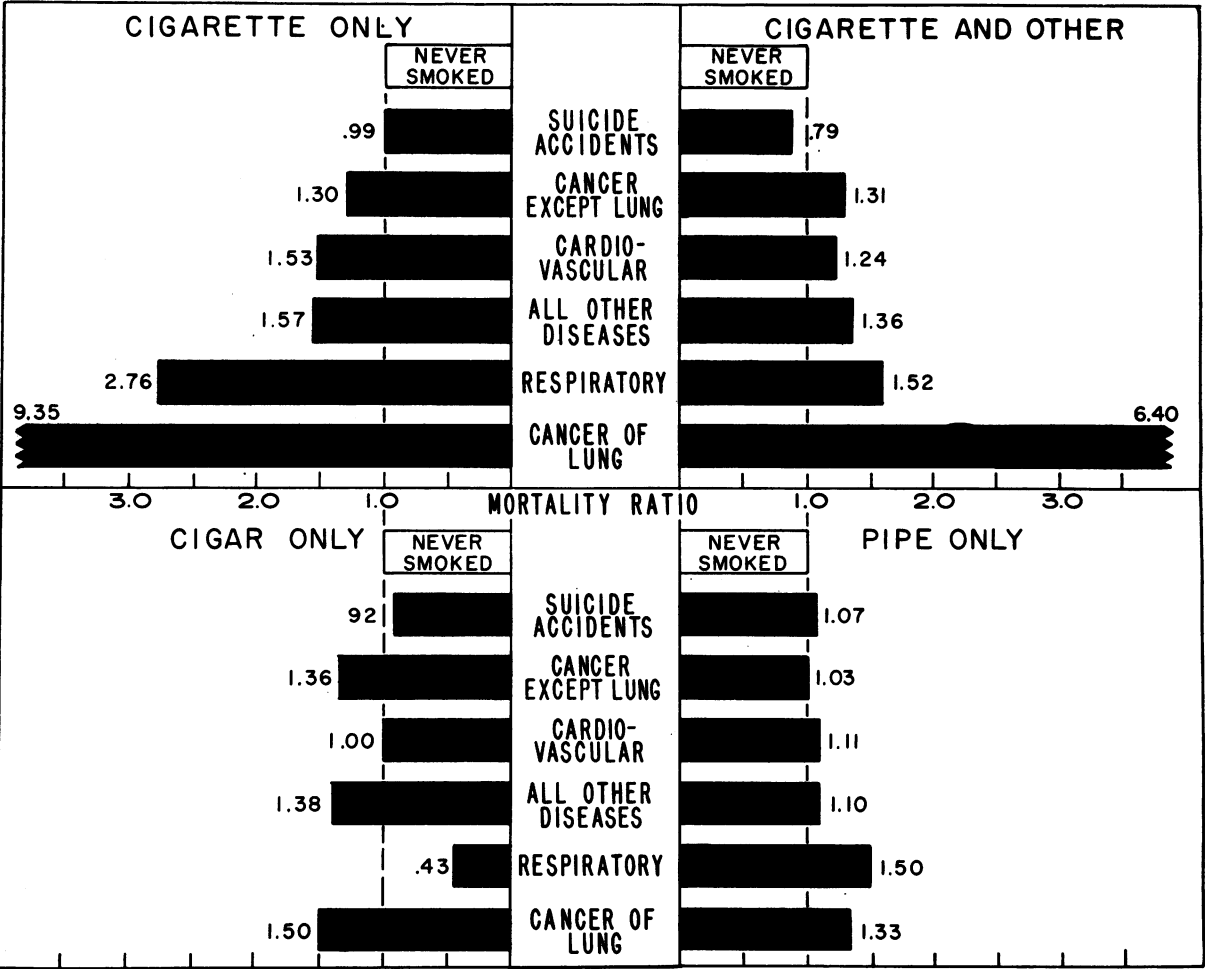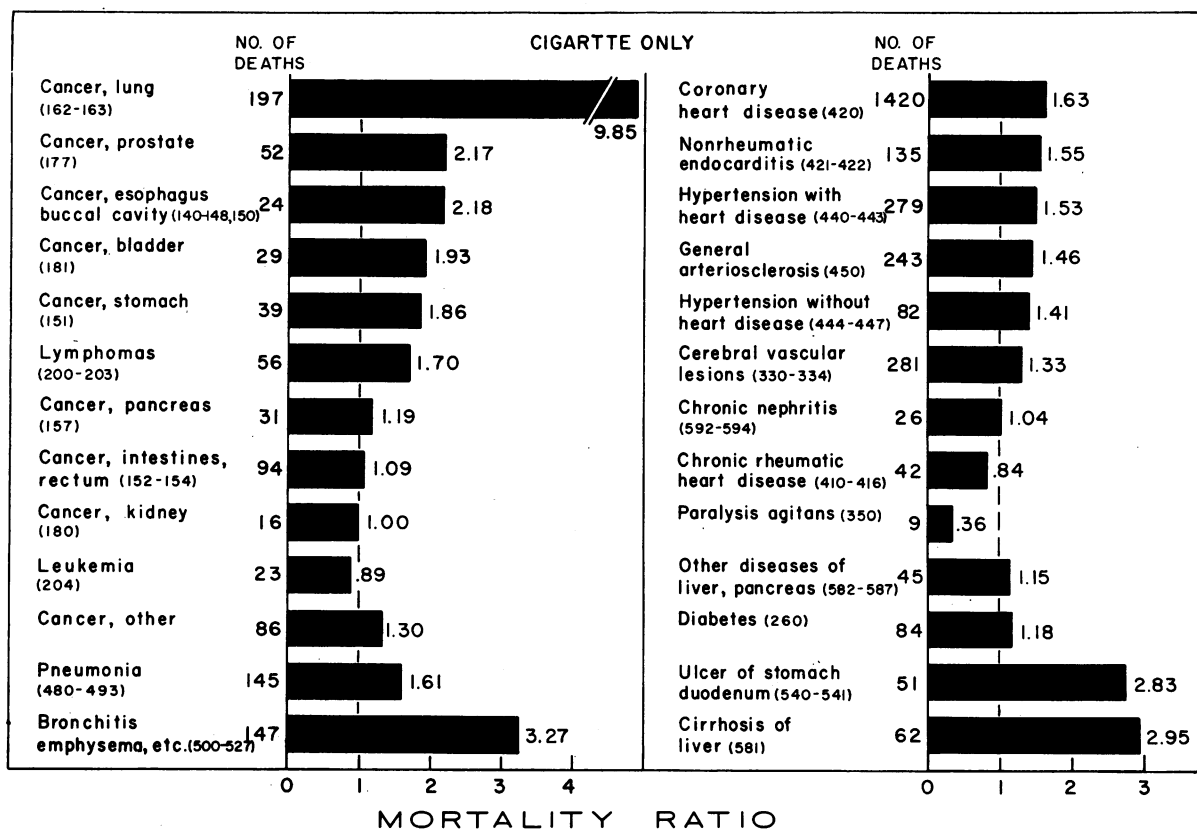
Figure 6. Mortality of regular smokers of cigarettes only from specific diseases; ratio of observed to expected number of deaths; death rate of nonsmokers and persons who have smoked only occasionally equals 1.00.

	NO. OF DEATHS	CIGARTTE ONLY		NO. OF DEATHS	
Cancer, lung (162-163)	197	9.85	Coronary heart disease (420)	1420	1.63
Cancer, prostate (177)	52	2.17	Nonrheumatic endocarditis (421-422)	135	1.55
Cancer, esophagus buccal cavity (140-148,150)	24	2.18	Hypertension with heart disease (440-443)	279	1.53
Cancer, bladder (181)	29	1.93	General arteriosclerosis (450)	243	1.46
Cancer, stomach (151)	39	1.86	Hypertension without heart disease (444-447)	82	1.41
Lymphomas (200-203)	56	1.70	Cerebral vascular lesions (330-334)	281	1.33
Cancer, pancreas (157)	31	1.19	Chronic nephritis (592-594)	26	1.04
Cancer, intestines, rectum (152-154)	94	1.09	Chronic rheumatic heart disease (410-416)	42	.84
Cancer, kidney (180)	16	1.00	Paralysis agitans (350)	9	.36
Leukemia (204)	23	.89	Other diseases of liver, pancreas (582-587)	45	1.15
Cancer, other	86	1.30	Diabetes (260)	84	1.18
Pneumonia (480-493)	145	1.61	Ulcer of stomach duodenum (540-541)	51	2.83
Bronchitis emphysema, etc. (500-527)	147	3.27	Cirrhosis of liver (581)	62	2.95

MORTALITY RATIO

clude cases with a cancer which the physician stated did not contribute to death. Examples of the latter are skin cancer or clinically quiescent cancer of the prostate discovered during autopsy. One hundred and seventeen of the persons who died had a cancer which was not considered one of the causes of death by the attending physician. Eight of these were cancer of the lung.

The selection of one of several coexisting diseases as the underlying cause of death frequently must be rather arbitrary. In studies of the etiology of disease the important question is whether or not a given disease has developed, not whether this disease has been designated by some method as the underlying cause of death. Hence the data in figure 6 are based on the number of cases of a specified disease. If a policyholder had both diabetes and cancer of the lung, he was counted twice, once in the group with diabetes and once in the group with cancer of the lung. Consequently, the sum of the numbers of observed deaths is greater than the number of persons who died.

The expected number of deaths on which the mortality ratios by cause are based were computed from the death rates for persons who had never smoked and those who had smoked only occasionally in order to have a statistically more stable basis of comparison. The only cause in table 4 for which the death rates for these two groups differed appreciably is cancer of the lung. There were 10 deaths among persons with lung cancer from the 89,774 person-years exposure of the never-smoked group and 7 deaths from the 28,144 person-years exposure of persons who smoked only occasionally. The corresponding crude death rates were 11 and 25 per 100,000, but this difference is not statistically significant. For simplicity of expression the combined group will be referred to as having never smoked.

Mortality From Broad Cause Groups

By far the greatest increase for smokers in the risk of developing a disease is that for lung cancer. For all persons who had ever smoked the observed number of cases of lung cancer was 312 compared with 52 expected, a mortality ratio of 6.0 (table 4). However, the amount of the increased risk varies widely among the various groups of smokers, ranging from an excess of 33 percent for pipe smokers to 835 percent for cigarette-only smokers. The mortality ratio for none of the three cigar-pipe-smoking groups differs significantly from one; the ratio for the three combined, 1.60, is barely significant at the 5 percent level.

For no other disease does the excess mortality among smokers approach that for lung cancer. The next highest mortality ratio is for a group of respiratory diseases including pulmo-

nary tuberculosis, asthma, bronchitis, emphysema, pneumonia, and pleurisy (fig. 5). Although these diseases are important causes of morbidity, they are numerically unimportant as primary, or underlying, causes of death; only 118 deaths among smokers and 24 deaths among nonsmokers were due directly to one of this group of diseases. The majority of these deaths were attributed to bronchitis, emphysema, pleurisy, empyema, fibrosis of the lung, and similar conditions.

An increased death rate from this group of respiratory diseases is found only among regular cigarette smokers, for whom the mortality ratio is 2.24. As for lung cancer, the highest ratio for respiratory diseases, 2.76, is for persons who smoke cigarettes only. Although the number of deaths among persons who regularly smoke only cigars or a pipe is small, there is

Figure 7. Mortality of regular smokers of cigarettes only, by current amount smoked in 1954 and specific disease; ratio of observed to expected number of deaths; death rate of nonsmokers and persons who have smoked only occasionally equals 1.00.
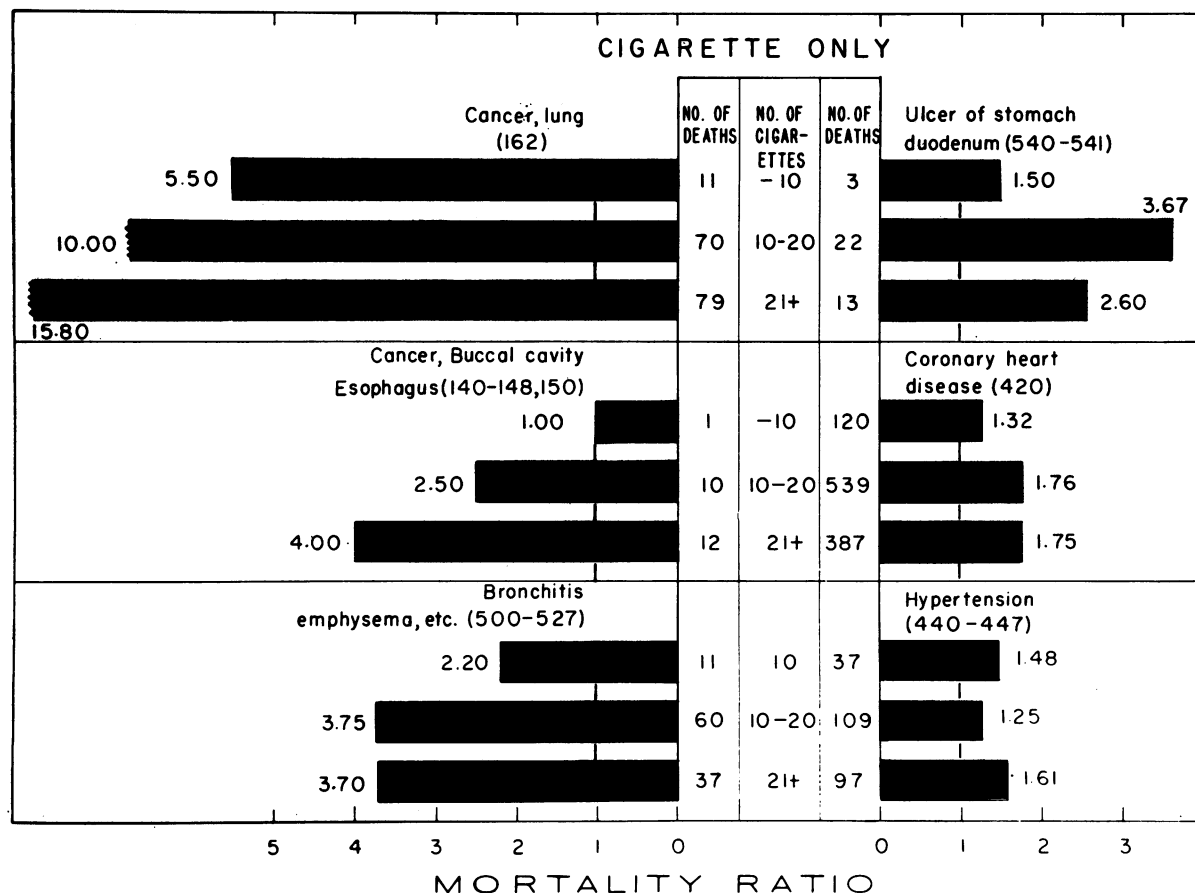
Table 5. Mortality of regular cigarette smokers from specific diseases by amount smoked: Ratio of observed to expected number of deaths of persons who had regularly smoked cigarettes only, by current amount smoked in 1954, July 1954–December 1956 [1]

Disease	Ratio of observed to expected deaths [2]			Number of observed deaths		
	Current amount smoked					
	Less than 10	10–20	21 or more	Less than 10	10–20	21 or more
Cancer of lung (162, 163)	5. 50	10. 00	15. 80	11	70	79
Cancer of prostate (177)	1. 67	2. 00	2. 33	5	16	14
Cancer of mouth, pharynx, and esophagus (140–148, 150)	1. 00	2. 50	4. 00	1	10	12
Cancer of bladder (181)	1. 00	1. 83	2. 75	2	11	11
Cancer of stomach (151)	4. 50	2. 00	1. 40	9	14	7
Malignant lymphomas (200–203)	. 67	1. 91	1. 89	2	21	17
Cancer of pancreas (157)	. 67	1. 00	2. 00	2	9	14
Cancer of intestines and rectum (152–154)	1. 22	1. 00	1. 14	11	30	25
Cancer of kidney (180)	1. 50	1. 17	. 75	3	7	3
Leukemia (204)	. 33	. 78	1. 43	1	7	10
Cancer, other forms	1. 00	1. 39	1. 39	7	32	25
Pneumonia (480–493)	1. 70	1. 78	1. 82	17	57	40
Bronchitis, emphysema, and allied diseases (500–527)	2. 20	3. 75	3. 70	11	60	37
Arteriosclerotic (coronary) heart disease (420)	1. 32	1. 76	1. 75	120	539	387
Nonrheumatic chronic endocarditis (421–422)	1. 30	1. 68	1. 62	13	52	34
Hypertension with heart disease (440–443)	1. 32	1. 34	1. 63	25	87	75
General arteriosclerosis (450)	. 84	1. 62	1. 46	16	97	57
Hypertension without heart disease (444–447)	2. 00	1. 10	1. 57	12	22	22
Cerebral vascular lesions (330–334)	1. 54	1. 27	1. 46	37	95	73
Chronic nephritis (592–594)	0	1. 00	1. 14	0	9	8
Chronic rheumatic heart disease (410–416)	. 80	. 94	. 77	4	16	10
Paralysis agitans (350)	. 33	. 11	. 17	1	1	1
Other diseases of liver, gallbladder, and pancreas (582–587)	1. 00	. 64	1. 50	4	9	15
Diabetes (260)	. 62	. 96	1. 39	5	24	25
Ulcer of stomach and duodenum (540–541)	1. 50	3. 67	2. 60	3	22	13
Cirrhosis of liver (581)	3. 00	3. 14	4. 17	6	22	25

[1] Underlying and contributory causes of death.
[2] Expected number of deaths computed by multiplying the number of person-years exposure in each age group by the age-specific death rates from each cause of death (including underlying and contributory causes) of persons who had never smoked or who had used tobacco only occasionally.

no evidence that this group experiences a higher death rate from these respiratory diseases than do nonsmokers.

Nearly two-thirds of the deaths of persons who had used tobacco were attributed to diseases of the cardiovascular-renal system, including chronic nephritis, arteriosclerosis, hypertension, rheumatic heart disease, chronic endocarditis, and coronary occlusion, sclerosis, and thrombosis. The risk of dying from one or more of these diseases is 31 percent greater for regular smokers than for nonsmokers. Again, the risk is greater for regular cigarette users, especially those who have smoked only cigarettes, than it is for users of other forms of tobacco. There is no indication that regular cigar or pipe smokers experience a higher death rate than nonsmokers.

The mortality ratios for cancer other than cancer of the lung are similar in magnitude to those for cardiovascular diseases except that the ratios for cigar and pipe smokers are as high as those for cigarette smokers. The mortality from these forms of cancer will be discussed in more detail below.

Smokers have no greater risk of committing suicide or of being killed in an accident than do nonsmokers.

Mortality From Specific Causes

As was pointed out above, the death rates for each of the specific diseases include all patients with the disease at the time of death, irrespective of whether or not it was considered the underlying cause. However, a disease was not coded in the absence of evidence that it was clinically active.

Diseases with a mortality ratio greater than 2.0, signifying a death rate more than double that for nonsmokers, are bronchitis, emphysema, and allied respiratory diseases, cirrhosis of the liver, ulcer of the stomach or duodenum, cancer of the prostate, and cancer of the esophagus and buccal cavity (fig. 6). Several studies have reported that heavy smokers also tend to drink alcoholic liquors excessively so that the increased death rate from cirrhosis of the liver may reflect the effect of the consumption of alcohol rather than any effect of cigarette smoking. An increased mortality of cigarette smokers from the other diseases mentioned has been reported in other studies also. An explanation of the high mortality ratio for cancer of the prostate is not apparent.

The death rates from the principal cardiovascular diseases are from 33 percent to 63 percent greater for regular cigarette-only smokers than for nonsmokers. No increase in mortality exists for chronic rheumatic heart disease or for chronic nephritis.

Mortality ratios by current amount smoked for men who were regularly smoking cigarettes only are shown in table 5. The number of observed deaths for several diseases is not large enough to establish that the mortality ratio for heavy smokers is significantly greater or less than the ratio for light smokers. Among these diseases are cancer of the stomach and cancer of the kidney, for which the death rates are lower for heavy than for light smokers, and cancer of the bladder, cancer of the pancreas, and leukemia, for which the death rates are higher for heavy smokers than for light smokers.

But for cancer of the lung and cancer of the buccal cavity and esophagus, the death rate increases rapidly with an increase in the average daily number of cigarettes smoked. The death rate from lung cancer for men who regularly were smoking more than a pack of cigarettes a day is nearly 16 times the rate for nonsmokers (fig. 7). A similar, although numerically smaller, increase in the mortality ratio with an increase in the number of cigarettes smoked exists also for cancer of the buccal cavity (lip, tongue, mouth, pharynx) and esophagus.

The leading cause of death of the policyholders included in this study is coronary heart disease. Although no difference was found in the death rates for moderate and heavy smokers, those smoking more than 10 cigarettes per day, these rates are greater than that for persons smoking less than 10 cigarettes per day. The difference, however, is considerably less than the corresponding difference for lung cancer. The death rates from hypertension, cerebral vascular lesions, chronic nephritis, and chronic rheumatic heart disease are no higher for heavy than for light smokers.

Summary

1. This report summarizes the mortality experience of nearly 200,000 policyholders of U.S. Government life insurance from July 1954 through December 1956. All these policyholders served in the Armed Forces of the United States between 1917 and 1940.

2. The death rate from all causes for men who have used tobacco is 32 percent greater than that for men who have never smoked.

3. Men who have smoked regularly only cigarettes have the highest death rate of all groups of smokers, 58 percent greater than the rate for nonsmokers.

4. The death rate from all causes for men who have regularly smoked cigars or a pipe, or both, is not appreciably higher than that for nonsmokers.

5. Regular cigarette smokers who had stopped smoking cigarettes before the study began in 1954 have a lower mortality rate than those who continued to smoke. However, the rate for the ex-smokers still is 31 percent greater than that of nonsmokers.

6. The excess mortality of regular cigarette smokers is greater for heavy smokers than for light smokers. Only the heaviest users of cigars and pipe tobacco experience a significant increase in total mortality over that of men who have never smoked.

7. The greatest increase for smokers in the risk of developing a disease is for cancer of the lung. The mortality ratio for regular smokers of cigarettes only is 9.85, or about 10 times that for nonsmokers. The death rate for men smoking more than a pack of cigarettes a day is 16 times that of nonsmokers.

8. Regular users of cigars or a pipe, or both, have an increased mortality rate for cancer of the lung as well as for all forms of cancer as a group, but this increase is much less than that for cigarette smokers.

9. Regular cigarette smokers are subject also to an increased risk of dying from cardiovascular disease, from certain respiratory diseases such as bronchitis, pleurisy, and emphysema, from ulcers of the stomach and duodenum, and from cirrhosis of the liver.

10. The death rate from coronary heart disease among regular users of cigarettes only is 63 percent higher than the rate for nonsmokers.

11. The leading cause of death among the policyholders is coronary heart disease. Forty-four percent of the number of observed deaths and 45 percent of the number of excess deaths—the difference between the number of observed deaths and the number of deaths expected on the basis of the rates for nonsmokers—for cigarette-only smokers were attributed to coronary heart disease. Corresponding percentages for lung cancer were 7 and 17.

Institutes in Care of Premature Infants

Announcement of the 1959–60 schedule of the institutes for physicians and nurses in the care of premature infants at the New York Hospital-Cornell Medical Center marks the 11th year of this service. The institutes are sponsored by the New York State Department of Health and the Children's Bureau.

Designed to meet the needs of physicians and nurses in charge of hospital premature nurseries and special premature centers, and medical and nursing directors and consultants in State and local premature programs, each course is limited in attendance to six physician-nurse teams. The program for physicians is of 2 weeks' duration and for nurses, 4 weeks. Participants pay no tuition and stipends are provided to assist with expenses during attendance.

Early application is essential for the 1959–60 institutes, which will start in 1959 on September 21 and November 2; in 1960, January 4, February 8, and May 9.

Additional information may be obtained by writing Box 143, Institute in the Care of Premature Infants, New York Hospital, 525 East 68th Street, New York 21, N.Y.

Signs and Symptoms

of trends in public health

The relationship of exercise to coronary heart disease is the subject of a study by J. N. Morris, F.R.C.P., D.P.H., and Margaret D. Crawford, M.D., of London Hospital printed in the *British Medical Journal* (December 20, 1958). The authors suggest that the physical activity of work is a protection and that persons whose jobs involve little or no physical activity are relatively more vulnerable.

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Reduction of 17 percent in traffic deaths in Iowa during 1958 is attributed by Safety Commissioner Russell Brown largely to radar speed checks and a point plan for ruling reckless drivers off highways.

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Comfortable earplugs that would shut out deafening noises have been recommended by Dr. Aram Glorig, head of the American Academy of the Ophthalmology and Otolaryngology's research center on noise in industry. He says that workers who wear earplugs have normal hearing at the end of a working day. Those who do not wear plugs lose hearing, particularly at 4,000 cycles.

Some workers object to wearing earplugs, fearing that warning cries of danger would go unheard. Glorig says that the opposite is true. Loud noises are shut out by the plugs and speech is made more intelligible.

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The College of American Pathologists has supplied 180,000 practicing physicians with a booklet on cytodiagnosis as an aid to early detection of cancer. The college plans to distribute copies to medical students graduating in the next 5 years.

The Virginia Farmers Union has protested a bill in the South Dakota legislature requiring that its cigarette tax stamps carry skull and crossbones.

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A new virus laboratory, in construction in Connecticut, will be equipped for cultural studies, particularly on poliomyelitis, ECHO and Coxsackie infections, smallpox, and herpes, for the Connecticut State Department of Health.

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Fires killed at least 11,500 persons and destroyed property valued at a record of $1,305,000,000 during 1958, estimates the National Fire Protection Association. Loss of lives was 200 more than in 1957.

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The first major intensified tuberculin skin-testing program for urban public and parochial senior high school students and personnel is being conducted by the District of Columbia Health Department under grant of $10,000 from the D.C. Tuberculosis Association.

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By 1980, industry will have to find safe ways to segregate 100 million gallons of highly radioactive waste materials having a radioactivity equal to 100 billion curies, Dr. Abel Wolman of the Johns Hopkins University testified in hearings before the Joint Congressional Committee on Atomic Energy. Dr. Wolman also said that rapid development of the atomic energy industry is in no small measure contingent on finding safe and economical methods of waste disposition.

Elderly people's needs of employment, health, nutritional, and housing services are under investigation in Paterson by the division of aging of the New Jersey Department of Health. Interviews are being conducted by 150 volunteers.

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Every driver-education car should be equipped with properly installed seat belts, and education in their use should be part of every driving course, according to Dr. A. L. Chapman, chief, Division of Special Health Services, Public Health Service.

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Three studies on ways to improve automobile driving were described by Dr. James L. Malfetti, executive officer of Columbia University's Safety Education Institute. The first study is measuring antisocial traits of traffic law violators; another is working on a method for selecting driver-training teachers likely to be most successful; and a third is studying driver behavior in critical situations.

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A record low disabling injury frequency rate of 2.98 each million man-hours worked during 1958 has been reported by the chemical industry, a 61 percent improvement over the 7.65 rate reported in 1946.

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The United States suicide rate was 9.8 persons for each 100,000 population in 1957, reports the National Office of Vital Statistics.

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The United States-Mexico Border Public Health Association reports a 60 percent growth in membership during 1958.

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Infants less than 1 year old who are tuberculin-positive, and children between 1 and 4 years of age for whom there is X-ray evidence of active, primary tuberculosis, should be treated with daily doses of isoniazid, the Public Health Service recommends on the basis of a study of 2,750 children.