

### *Causes of Death among Anesthesiologists: A 20-Year Survey*

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During the years 1947-1966, there were 441 deaths among junior, active and retired members of the American Society of Anesthesiologists living in the United States or Canada. A cause of death was found for each member and death rates calculated for this group. Comparisons of these rates with those for U. S. males and with male policyholders of the Metropolitan Life Insurance Company were made. Anesthesiologists appear to have a low incidence of lung cancer, a somewhat lower than average incidence of coronary artery disease in recent years, and a high death rate from suicide and malignancies of the lymphoid and reticuloendothelial tissues. These data only suggest trends and point to the need for a prospective study of this subject.

RESEARCH currently being conducted in several laboratories indicates that many anesthetic agents produce toxic effects in animals if given over periods of many days. These pathologic changes seem to occur most frequently in cellular systems intimately involved in division and differentiation. The develop-

ing chick and rat embryo and the rat bone marrow have received the greatest attention.<sup>1</sup>

In man, only industrial workers and anesthesiologists would be exposed to these anesthetics for long periods of time. We have learned from correspondence with the manufacturers of halothane and methoxyflurane that employees in their plants have essentially no exposure to these anesthetics due to modern, automated manufacturing techniques. Data are not available from anesthesiologists. We believed it would be worthwhile to investigate the causes of mortality among anesthesiologists, paying particular attention to the incidences of diseases of the hematopoietic and lymphoid tissues, compared with the incidences in a non-anesthetist population of otherwise similar character. This paper concerns a survey made of all known deaths among members of the American Society of Anesthesiologists (ASA) from January, 1947 through December, 1966.

#### Methods

The population from which the deceased members came was defined strictly and subjected to certain arbitrary assumptions. Only junior, active and retired members of the ASA who lived in the United States or Canada were included. Although a spot-check in the 1966 ASA Directory of Members indicated that approximately 12 per cent of names of recognizable gender were female, we could not be sure of the sex of many members. Consequently, for statistical purposes we have regarded the population as entirely male. Similarly, the age distribution among the living members for these years was unknown. A survey of the ages of 200 members whose names were selected at random, was made

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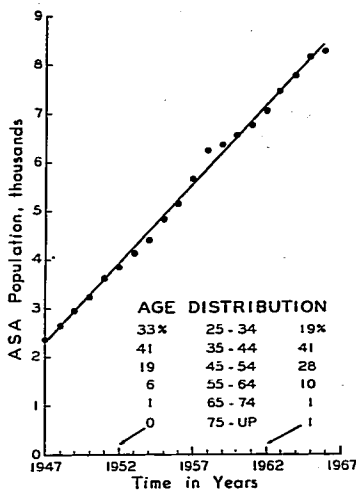


FIG. 1. Population of the A.S.A. for the period 1947 through 1966. Point for each year represents the total number of active, junior and retired A.S.A. members living in the United States and Canada. Insert gives the estimated per cent distribution by age for the years 1952 and 1962.

for each of the years 1952 and 1962. The ages were calculated by reference to the birth dates given in the American Medical Directory. Age distributions for these two years were computed and we have assumed that these were constant for each of the two decades being considered.

The names of the 441 members who died in the two decades were furnished by the ASA Headquarters. These names were then taken to the death files of the American Medical Association where a cause of death was recorded for approximately 340 individuals. The remainder included cases where a file card was unavailable, where a card was present but a cause of death was not listed, or the cause listed was sufficiently vague to warrant further investigation. In these cases, letters of inquiry were sent to family, friends or professional colleagues. Finally, in the absence of replies or suitable information, the telephone was resorted to. Eventually, a satisfactory

explanation of death was found for all of the 441 members.

Because of the small number of deaths a year-by-year analysis of the data was not feasible. Data have been grouped according to the two decades, 1947-1956 and 1957-1966. Deaths were recorded according to age at death, year of death and cause of death. These were coded according to the International Classification of Diseases, Injuries and Causes of Death, 7th Revision, of the World Health Organization. Comparisons were made with two groups of white males, adjusted to the estimated ASA population distribution: U. S. white males, whose data were obtained from the Bureau of Vital Statistics; and white male policyholders of standard ordinary life insurance with the Metropolitan Life Insurance Company. Ratios of observed to expected deaths from differing causes for each of the 10-year groupings were computed from these data. Due to the small number of deaths in our sample, the findings may be subject to large random fluctuation. Our data, therefore, only suggest trends for further consideration and study.

TABLE 1. Causes of Death of A.S.A. Members from 1947-1966

Cause	Number	Per cent
Cardiovascular-renal		
Vascular, CNS	34	7.7
Coronary, ASHD	203	46.0
Chronic nephritis	11	2.5
Other	19	4.3
TOTAL	267	60.5
Malignant neoplasms		
Digestive	23	5.2
Respiratory	9	2.0
Leukemia	6	1.4
Lymphoid-R.E.S.	17	3.8
Other	16	3.7
TOTAL	71	16.1
Accidents	29	6.6
Suicides	35	7.9
Other causes	39	8.8
All causes	441	100.0

TABLE 2. Ratio of A.S.A. Death Rates to "Control" Group Rates

Cause of Death	Ratio of A.S.A. Rates to:			
	U. S. White males		Standard Policy Holders	
	1947-56	1957-66	1947-56	1957-66
All causes	0.74	0.51	1.04	0.60
Cardiovascular-renal	1.07	0.54	1.44	0.61
Vascular, CNS	0.75	0.65	1.30	0.77
Coronary, ASHD	1.39	0.60	1.48	0.62
Chronic nephritis	1.03	2.16	—	—
Accidents	0.22	0.49	0.41	0.76
Suicides	1.22	1.44	2.20	2.86
Malignant neoplasms	0.59	0.54	0.60	0.56
Digestive	—	0.68	0.62	0.64
Respiratory	—	0.32	0.11	0.30
Leukemia	1.18	0.83	1.33	0.91
Lymphoid-R.E.S.	2.50	1.75	—	—
All other causes	0.34	0.22	0.58	0.30

Results

Figure 1 shows the growth rate of the A.S.A. population investigated for the period of our study. Estimates of the age distribution for 1952 and 1962 are included in the figure.

Causes of the 441 deaths are summarized in table 1, which tabulates the actual numbers of deaths in, and per cent of total represented by, each category. The chronic nephritis group includes five former members whose cause of death was "uremia" and who might not, in fact, have had uremia as a primary disease. We have divided malignant neoplasms into subgroups: digestive and respiratory cancer, and leukemia and "lymphoid-R.E.S." These will be considered separately.

Ratios of A.S.A. death rates in these categories to death rates for white males among the U. S. population and among Metropolitan policyholders are shown in table 2. Malignant neoplasms included under "lymphoid-R.E.S." were those coded 200-203 in the standard classification of the World Health Organization (table 3). There were 17 such cases, itemized by type in table 4. These accounted for almost one-fourth of all malignancies recorded, whereas the deaths from the usually more common malignancies of the gastrointestinal and respiratory systems were lower than expected (table 2).

Comparisons by age of the observed to expected ratios of deaths from these malignancies during the 20 years are shown in table 5. These data also are shown graphically in figure 2. Comparisons were made only with the U. S. male population since the Metropolitan Life Insurance Company does not tabulate these diseases separately due to their comparative rarity. They do, however, separate leukemia, and comparisons of the A.S.A. death rates from leukemia with the two "control" populations are given in table 6.

Coronary and arteriosclerotic heart disease accounted for 46 per cent of the 441 deaths

TABLE 3. Neoplasms of Lymphatic and Hematopoietic Tissues

200	Lymphosarcoma and reticulosarcoma
200.0	Reticulum-cell sarcoma
200.1	Lymphosarcoma
200.2	Other primary malignant neoplasms of lymphoid tissue
201	Hodgkin's disease
202	Other forms of lymphoma (reticulosis)
202.0	Giant follicular lymphoma (Brill-Symer's disease)
202.1	Other
203	Multiple myeloma (plasmacytoma)

Source: Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death. 7th Revision, 1957.

TABLE 4.

Total number of malignancies—71 (16.1% of 441 deaths)			
Malignancies, lymphoid and reticuloendothelial tissues:			
Lymphosarcoma	9		
Hodgkin's disease	4	17/71 = 23.9%	of malignancies
Multiple myeloma	4		
TOTAL	17		

in the A.S.A. group. A comparison of death rates by age groups is given in table 7. When the rates for 1947-1956 and 1957-1966 were compared, there was a decreased rate in the recent decade. The A.S.A. rate compares favorably with that of the population at large.

Suicides were 1.5 times as frequent in the A.S.A. as in the U. S. male population in general, and 2.73 times the rate of Metropolitan male policyholders. A breakdown by age groups is given in table 8.

### Discussion

Owing to the assumptions made concerning the population studied and the small numbers of deaths, only trends may be suggested by these data. The need for a prospective, statistically-sound study is pointed out by certain findings, however.

As expected, disease of the coronary arteries is the primary cause of death among anesthesiologists as well as in the general population. According to Russek,<sup>2</sup> this disease is much more prevalent among anesthesiologists than among the general population. Our data do not confirm this in the second decade of the study and indicate the death rate from this cause is actually *less* than in other populations.

Discounting the one high figure for "chronic nephritis" as spurious, A.S.A. members have apparently high death rates from malignancies of the lymphoid and reticuloendothelial tissues, and from suicide. The death rate from lung cancer is unexpectedly low. Perhaps the question of smoking habits of anesthesiologists deserves further inquiry.

The high death rate from lymphoid and R.E.S. malignancy may not be causally related to the practice of anesthesiology. On

the other hand, it could relate to the toxicity of inhaled anesthetics or to an environmental hazard as yet unidentified. Radiation exposure as a cause seems highly unlikely due to the normal rate for leukemia, a disease well established as causally related to radiation.<sup>3</sup>

The suicide rates among physicians in general exceeds that of the population as a whole and De Sole and his co-workers (personal communication) have evidence that anesthi-

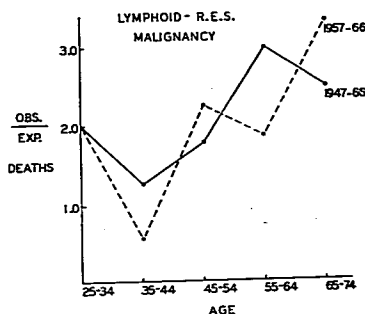


FIG. 2. Deaths from tumors of the lymphoid and reticuloendothelial tissues in A.S.A. members for the 20-year period of study. These are plotted as the observed number of cases divided by the number to be expected, based on the incidence in the U. S. male population as reported by the Bureau of Vital Statistics. The abscissa designates the age distributions for which the ratios were calculated. The solid line represents the entire 20 year period, and the broken line the second decade of this period. Were there no differences, a flat line at 1.0 should occur.

TABLE 5. Deaths from Lymphoid-R.E.S. Malignancy, 1947-1966

Age	Observed	Expected*	O/E
25-34	2	1.0	2.00
35-44	3	2.4	1.25
45-54	5	2.8	1.79
55-64	6	2.0	3.00
65-74	1	0.4	2.50
75-84	0	0.3	—
TOTAL	17	8.9	1.91

\* U. S. males.

TABLE 6. Leukemia, 1947-1966

Age	U. S. Males			Insured		
	Obs.	Exp.	O/E	Obs.	Exp.	O/E
25-34	0	0.7	—	0	0.8	—
35-44	2	1.6	1.25	2	0.9	2.22
45-54	3	1.7	1.76	3	1.5	2.00
55-64	1	1.4	0.71	1	1.4	0.71
65-74	0	0.4	—	0	0.3	—
75-84	0	0.4	—	0	0.6	—
TOTAL	6	6.2	0.97	6	5.5	1.09

TABLE 7. Coronaries, A.S.H.D., 1947-1966

Age	U. S. Males			Insured		
	Obs.	Exp.	O/E	Obs.	Exp.	O/E
25-34	1	2.8	0.36	1	2.8	0.36
35-44	35	37.1	0.94	35	29.4	1.19
45-54	58	81.1	0.72	58	71.1	0.82
55-64	65	75.0	0.87	65	69.5	0.94
65-74	31	20.2	1.53	31	19.8	1.57
75-84	13	26.8	0.49	13	34.9	0.37
TOTAL	203	242.9	0.84	203	227.5	0.89

ologists have a relatively high suicide rate as compared to other specialty groups. There is nothing in our findings to cast light on the reasons for this.

A prospective study is presently being organized, in which each A.S.A. member will be identified by sex, age, race, extent of practice of anesthesiology, and compared with a similar number of non-anesthesiologist policyholders of the Metropolitan Life Insurance Company. With careful reporting of all deaths over the next few years, a much clearer picture of the mortality experience of anesthesiologists will emerge.

**Summary**

The data presented should be considered as only a summary of the causes of death among anesthesiologists. Some of the trends uncovered, however, are of sufficient importance to warrant further investigation and the institution of means for obtaining totally reliable data.

The incidence of death from malignancies affecting the lymphoid and reticuloendothelial tissues appears to be appreciably higher among anesthesiologists than in the general population.

The death rate from suicide among anesthesiologists appears to be more than twice that of a comparable socioeconomic group of the general population. The high death rate from this cause among anesthesiologists below the age of 45 years is of special concern.

Malignancies of the respiratory tract seem to be an uncommon cause of death among anesthesiologists.

TABLE 8. Suicides, 1947-1966

Age	U. S. Males			Insured		
	Obs.	Exp.	O/E	Obs.	Exp.	O/E
25-34	9	3.4	2.65	9	2.1	4.29
35-44	14	8.7	1.61	14	4.3	3.26
45-54	8	7.2	1.11	8	4.1	1.95
55-64	3	3.2	0.94	3	1.9	1.58
65-74	1	0.5	2.00	1	0.2	5.00
75-84	0	0.4	—	0	0.2	—
TOTAL	35	23.4	1.50	35	12.8	2.73

While coronary artery disease is the most common cause of death among anesthesiologists, the overall incidence is less than would be anticipated either in the general male population or in a comparable socioeconomic group.

We are grateful to Mr. John Andes, Executive Secretary of the A.S.A., for his assistance, and to the American Medical Association for the use of their death files. The cooperation of many members of the Society in providing information both by mail and by telephone contributed materially to the completion of this survey.

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