AVERAGE AGE AT DEATH OF SCIENTISTS IN VARIOUS SPECIALTIES

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THE LACK of information about the longevity (length of life) of scientists and about differences among the various scientific specialties seems to point to a promising area for investigation. Although the National Center for Health Statistics, formerly the National Office of Vital Statistics, published a detailed breakdown in 1950 of the death rates for the manual trades (*1*), its breakdown for scientists was much less complete. The National Academy of Sciences-National Research Council has also published a statistical analysis of scientists which contained a great deal of information, but life expectancy and mortality tables were lacking (*2*).

An analysis has been made of the deaths reported in *Science* from January 1958 through January 1968. The death notices were categorized by sex and major field of concentration.

Some differences in longevity of different groups of scientists have already been documented. A number of studies of physicians have indicated that their longevity is greater than that of the general population (*3*), and dentists have even greater longevity (*4*). In recent years several studies have shown that radiologists die earlier than physicians in other medical specialties (*5–7*).

Some obituaries were excluded in the tabulation because of lack of information as to the specialty of the deceased, the inability to make a selection of his main occupation from among several listed specialties, or the omission of his age.

The inclusions of specialties in a few categories require some explanation. For example, the medical category is a broad one, and it included all persons except psychiatrists who had some connection with the practice of medicine—veterinary medicine, hospitals, or medical schools. Although this broad grouping may not be as informative as hoped, this loss is not great, because the longevity of physicians has been studied more than that of any other professional group.

The agriculture category included agricultural science, forestry, conservation, and wildlife management. The earth sciences included persons working in geology, metallurgy, mining engineering, oceanography, and meteorology. Education included administrative positions at schools without any other information as to the person's original field. Engineering included engineers and inventors. The administration category was composed of men who had held administrative positions in private industry—but not in government or universities—regardless of their specialty.

From time to time, *Science* notes the death of prominent men who were not scientists. These persons together with three economists were tabulated in the nonscience category.

A number of men might well have been placed into more than one category. Typically, once a man had been tabulated in one category, however, he was not listed in any other. The one exception was the scientists listed in the radiation category. Each person in this group is also listed under another specialty, such as physics, biology, or medicine. No one was included in this category unless his obituary specifically indicated laboratory work with some form of radiation.

Results

The mean ages at death of the men in the various specialties are ranked in table 1 together with the number in each category and the standard deviations of the means. Archeologists had

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the highest average age at death, while administrators and men working with some form of radiation had the lowest average age at death. The difference between these extreme means was nearly 15 years, which was larger than the standard deviations associated with these means. The mean age at death for the entire sample of 2,224 men was 67.7.

The tabulations for women are given in table 2. Although there are few women in any given category, every specialty is represented except pharmacy. Despite the low correlation obtained between the rankings for men and women, the mean age at death for the three women who held administrative positions was 59.3; the one woman cited as having worked in a radiation laboratory died at 42; the women who lived the longest worked in the agricultural sciences, archeology, and engineering—specialties in which men also ranked high in longevity.

But of most interest is that the mean age at death for the 93 women in the sample was 68.1, virtually the same as that for the men. The longevity of 20-year-old white women is now 76.6 years compared with 70.2 for 20-year-old white men, a difference which declined little because the sample was restricted to much older persons (*8*). Interestingly, the average for the nonscientific group agrees with the average reported for the general population.

Table 1. Mean age at death and standard deviations of the means for male scientists, by specialty, 1958–68

Specialty	Number	Mean age (years)	S.D. ±
Archeology	12	76.7	10.7
Astronomy	41	75.8	11.8
Anthropology	18	72.2	11.3
Engineering	192	71.1	13.0
Sociology	23	71.0	12.0
Nonscience	70	70.0	14.1
Earth science	109	69.6	14.6
Agriculture	130	68.9	13.2
Medicine	493	68.8	12.9
Biology	322	68.5	15.2
Education	96	67.5	11.3
Chemistry	179	66.0	13.6
Psychiatry	47	65.9	10.5
Mathematics	51	65.5	13.5
Physics	176	64.4	16.0
Psychology	51	62.7	13.6
Pharmacy	34	62.3	13.9
Administration	180	61.8	12.4
Radiation	33	61.8	14.2
Total	2,224	67.7	

Comments

There seem to be sizable differences in the average longevity of the men in different scientific specialties whose deaths were reported in *Science*. The low average longevity of physicists may be the result of the inclusion of a large proportion of men working with radiation. What has caused the low averages for the psychologists and pharmacists? One possible factor may be an unusually high suicide rate among pharmacists. Powell (*9*) noted one study which showed the suicide rate of pharmacists was 120 per 100,000 compared with only 15 per 100,000 for engineers.

A sedentary occupation may result in a shorter life. In table 1 persons with the greatest longevities worked in such specialties as archeology, anthropology, earth sciences, and agricultural sciences—professions in which the essential business is conducted out of doors.

To examine this hypothesis further, the death notices from 1958 to 1962 were retabulated for the biologists. They constituted the largest sample except for medicine. Because biology is a diverse field, it is easily divided into outdoor and indoor groups. Persons specializing in botany, entomology, limnology, and zoology, for example, would seem to be out of doors more than persons working in such specialties as embryology, physiology, histology, or cytology. In fact, the mean age at death of the 114 biologists listed in the outdoor group was 70.0 (S.D.=14.2) while that for the 81 persons in the indoor group was 64.8 (S.D.=16.3). If this difference in longevity is valid, we still cannot say, of course, whether outdoor life leads to a longer life or whether healthier people gravitate toward outdoor occupations.

In a final analysis, the physicists, chemists, biologists—including the agricultural scientists—and the earth scientists who died between 1958 and 1962 were divided according to whether or not they had been employed primarily by universities. Table 3 shows that the university physicists, chemists, and earth scientists—but not the biologists—lived longer, on the average, than their nonuniversity counterparts.

These results conform to U.S. Government statistics which indicate that professional-tech-

nical people have higher mortality rates between the ages of 30 and 55 than the average for all the white occupational groups, while managers have slightly higher mortality rates than both of these after the age of 45 (*1a*). These results also conform to the various reports that radiologists have shorter lives. The differences are much greater than those previously observed, but the reason may be that the sample was composed mostly of physicists who are, presumably, working with some form of radiation of much higher energy than the medical radiologists in the previous studies.

Table 2. Mean age at death of female scientists, by specialty, 1958–68

Specialty	Number	Mean age (years)
Agriculture	1	84. 0
Archeology	1	83. 0
Engineering	1	82. 0
Education	5	76. 8
Psychiatry	2	74. 5
Physics	5	73. 6
Sociology	3	72. 7
Medicine	24	69. 2
Psychology	6	67. 8
Chemistry	6	66. 5
Biology	28	65. 6
Earth science	3	64. 3
Anthropology	1	62. 0
Astronomy	1	61. 0
Administration	3	59. 3
Mathematics	2	56. 2
Nonscience	1	56. 0
Radiation	1	42. 0
Total	93	68. 1

Table 3. Mean age at death and standard deviations of the means for scientists in universities compared with those employed elsewhere, 1958–62

Specialty	Number	Mean age (years)	S.D.±
University:			
Physics	55	69. 2	13. 9
Chemistry	47	67. 4	13. 2
Biology	152	67. 5	15. 5
Earth sciences	26	72. 2	13. 5
Nonuniversity:			
Physics	40	58. 7	16. 4
Chemistry	76	63. 1	13. 5
Biology	67	68. 4	15. 3
Earth sciences	38	66. 8	12. 4

Nevertheless, no validity or significance can be claimed for these differences without further information. A conclusive study would, first of all, have to be based on a more definitive examination of death notices. The basis for reporting deaths in *Science* was not determined. Other factors not determined were completeness of coverage and whether the likelihood of a death being reported was the same for those in different specialties, for active and retired persons, and for university and nonuniversity personnel.

There is, presumably, a tendency to report the deaths of the more notable persons. If physicists tend to become eminent earlier in their careers than do men in the earth sciences, then the death of a young physicist would be more likely to be noted than that of a young geologist.

What is more, one would expect to find different distributions for the specialties, since the earliest age at which a man would probably qualify for a given specialty will vary. For example, a man is considered to be an engineer after he has completed 4 years of college, but a physician must have an additional 4 years of education, and a psychiatrist must have had still more training.

A person generally does not become an administrator until he has had several years of experience, and not many men would achieve this position at an early age. Thus deaths would not be reported for psychiatrists or administrators as early in life as for engineers, simply because it is unlikely that many would have become psychiatrists or administrators that soon.

Conversely, physicists and psychologists may have a low average age at death because there are relatively large numbers of young men going into these specialties, increasing the chances that a young scientist in this age group would die. These examples make clear why the significance of the differences cannot be assessed without knowing the proportion of men and women in each age group for each specialty.

Although the results of this study are not conclusive, they do suggest an interesting area for inquiry.

Summary

Analysis of the average age at death of scientists whose death notices appeared in *Science*

from 1958 to 1968 showed great differences among the various specialties. They range from 76.7 for archeologists to 61.8 for men working with some form of radiation. The average age at death for the sample of 2,224 men was 67.7 years, and for the sample of 93 women, 68.1.

The average age at death was higher for biologists in outdoor specialties than it was for those in indoor specialties, and it was higher for physicists, chemists, and earth scientists—but not for biologists—working for universities than for their nonacademic counterparts.

More accurate death statistics and detailed information about the proportion of people in various age groups for each specialty are needed to determine whether or not these suggestive results are valid.

REFERENCES

(1) Guralnick, L.: Mortality by occupation and cause of death among men 20 to 64 years of age: United States 1950. Vital Statistics Special Reports, Vol. 53, No. 3. U.S. Government Printing Office, Washington, D.C., 1963; (a) pp. 105–111.

(2) National Academy of Sciences–National Research Council: Profiles of Ph. D.'s in the sciences. Publication No. 1293. U.S Government Printing Office, Washington, D.C., 1965.

(3) Dickenson, F. G., and Martin, L. W.: Physician mortality, 1949–1951. JAMA 162: 1462–1468 (1956).

(4) Luria, S.: Mortality among dentists: A four-year cohort study. Thesis. Yale University School of Medicine, New Haven, Conn., 1963.

(5) Warren, S.: Longevity and causes of death from irradiation in physicians. JAMA 162: 464–468 (1956).

(6) Lewis, E. B.: Leukemia and ionizing radiation. Science 125: 965–972 (1957).

(7) Seltzer, R., and Sartwell, P. E.: The influence of occupational exposure to radiation on the mortality of American radiologists and other medical specialists. Amer J Epidem 81: 2–22 (1965).

(8) Institute of Life Insurance: Life insurance fact book, 1967. New York, 1967, p. 94.

(9) Powell, H.: Occupation, status and suicide: Toward a redefinition of anomie. Amer Sociol Rev 23: 131–139 (1958).

ph synopses

COMPTON, ARIEL S. (Santa Clara County Health Department, San Jose, Calif.): *Health study of adolescents enrolled in the Neighborhood Youth Corps. Pilot screening program. Public Health Reports, Vol. 84, July 1969, pp. 585–596.*

A study of the health of 269 Neighborhood Youth Corps adolescents was made by the San Jose City Health Department between December 1966 and May 1967. The primary objective of this study was to identify health problems and provide the type of followup which would achieve medical care as well as to evaluate the need for future health programs for these youngsters.

Screening procedures consisted of a review of a medical history questionnaire, brief physical examination (school dropouts routinely and enrollees in school only as indicated), check of blood pressure and pulse, vision and hearing tests, dental inspection, blood and urine tests, tuberculin and histoplasmosis skin tests, and mental health interview.

The data from in-school enrollees were compared with that of school dropouts and, whenever possible, screening results were also compared with those from a health study of middle class high school students in Dormont, Pittsburgh.

Screening procedures revealed that among youth corps enrollees 34 percent of the girls and 17 percent of the boys had a significant hearing loss, 50 percent of enrollees needed immediate dental care, 13 percent were anemic, 18 percent had abnormal results for urine tests, approximately 10 percent had positive tuberculin skin tests, and 34 percent had emotional problems serious enough to warrant professional help. Observations during physical examinations identified 91 conditions among the 131 school dropouts which warranted medical attention. Among in-school enrollees, who were examined only when indicated by answers to the medical history questionnaire, 53 medical referrals were made.

For those procedures for which it was possible to compare results—vision and hearing tests, dental inspection, hematocrit value determination, tuberculin skin test, and nutritional evaluation—the health of youth corps enrollees was significantly below that of Dormont students. Examination of adolescents in the Dormont study did not reveal serious diseases; however, many youth corps enrollees had serious health problems.

School dropouts had a greater percentage of obesity, significant hearing and visual defects, urinary abnormalities, and anemia than did those in school. In some instances a health problem had been a primary factor in causing a youngster to become a dropout, and among in-school enrollees several health conditions were identified which directly affected academic performance.

Community services were not found adequate to meet the health needs as demonstrated by this study. If the goal of improving the health of these young people is to be achieved, a health program must do more than merely screen for health abnormalities; it must also provide services for treatment which are both acceptable and readily available to those who need them.

MARTIN, DAN A. (Acting Health Officer, Hopkins County, Ky.), FLEMING, SALLY J., FLEMING, TIMOTHY G., and SCOTT, DEANNA C.: ***An evaluation of immunization status of white children in a Kentucky county. Public Health Reports, Vol. 84, July 1969, pp. 605–610.***

The 453 infants that could be located among the 487 born to white residents in Hopkins County, Ky., in a recent 1-year period were divided into two groups. Parents of one group received mailed notices urging DPT (diphtheria-pertussis-tetanus) and poliomyelitis immunizations; parents of the other group did not. When the babies were 4 months old, the two groups did not differ in the percent of immunizations started. For approximately 20 percent of the 453 infants, neither DPT nor poliomyelitis immunizations had been initiated.

Study of a subgroup of 231 babies at 12 months of age showed that only 5 percent more received immunizations between 4 and 12 months of age than had received them by 4 months. Thirty-four infants of this subgroup had received no immunizations of any kind. A home visit by a public health nurse and a clerk resulted in completion of immunizations in eight of the 34; one mother refused to have her child immunized. The parents of two children had already voluntarily had them immunized before the visit. Families of 13 infants could not be located. A second home visit was planned to try to persuade the parents of the remaining 10 infants to provide the protection their children needed.

Families unlikely to have babies immunized by an acceptable time were characterized by poverty, rural residence, a mother with an education of 9th grade or less, and three or more children.

HOFF, WILBUR (California State Department of Public Health): ***Training the disadvantaged as home health aides. Programing success achieved by the Alameda County (Calif.) Health Department. Public Health Reports, Vol. 84, July 1969, pp. 617–623.***

The purpose of a project conducted during 1968 in the Alameda County Health Department, Oakland, Calif., with a 1-year grant from the Federal Office of Economic Opportunity, was to demonstrate how older unemployed men and women—most were 45 to 62 years old—in poverty areas could be trained to become effective home health aides.

An 11-week training program was designed to teach specific knowledges and skills of home nursing care. In developing the course, principles of programed learning were followed to (*a*) determine the characteristics of the trainees, (*b*) identify behavioral objectives, (*c*) break subject matter into small discreet steps, (*d*) arrange learning in a progressive sequence, and (*e*) allow trainees to progress at their own speed.

Of the 92 adults selected for the program, 83 (90 percent) successfully completed the course and were certified as home health aides. Results of the basic education instruction given to 65 percent of the trainees showed that after instruction the average increase in mathematics grade levels was 1.6. The range of increase for the trainees was from 1 to 3 grade levels.

A behavior-rating instrument, constructed to measure performance on the job, was used to evaluate the performance of 24 graduates of the program after 15 weeks of employment. Aides were rated by their nurse supervisors on 22 items in three important work-skill categories: technical home care, work habits, and interpersonal relations. The results of this evaluation showed that all the aides were performing at satisfactory or above-satisfactory levels.

CRAWFORD, CHARLES O. (Pennsylvania Department of Health): ***Variables related to a referendum vote on creating a county health department. Public Health Reports, Vol. 84, July 1969, pp. 639–646.***

The extent to which political, demographic, and socioeconomic characteristics of municipalities in Chester County, Pa., were related to percentage affirmative vote (PAV) on a referendum to establish a county health department was investigated. Chester County has 57 townships, 15 boroughs, and one city. Whether the municipality was a township, borough, or city proved to be a factor closely related to the percentage affirmative vote. The boroughs and city were more likely to vote for a department than were the townships.

Municipalities with higher and lower population growth rates had a higher PAV than those with moderate growth rates. Two intervening variables, however, were political organization and socioeconomic status. Boroughs and the city tended to have lower growth rates than townships. The municipalities with higher growth rates tended to have higher socioeconomic levels when measured by income and education.

Mobility was related to percentage affirmative vote in that municipalities with more mobile populations had a higher PAV than those with less mobile populations. Political organization of the municipalities had to be seriously considered when examining this relationship.

Income and education were related to PAV levels, with income data yielding more distinct relationships than educational levels. Municipalities with high socioeconomic ratings were more likely to have high PAV levels.

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CASPER, ELIZABETH A. (Public Health Service), and PHILIP, ROBERT N.: ***A skin test survey of tularemia in a Montana sheep-raising county. Public Health Reports, Vol. 84, July 1969, pp. 611–615.***

Three hundred and sixty-five persons from sparsely populated, sheep-ranching Garfield County in eastern Montana were skin tested for sensitivity to *Francisella tularensis*. Twenty-four persons (6.6 percent) were reactors: 19 (10 percent) of 194 males and five (3 percent) of 171 females. Only four reactors had a history of prior tularemia infection.

Although clinical tularemia had been consistently diagnosed and reported in Garfield County, the true incidence of tularemia infections had not been reflected. Most infections were unrecognized or subclinical. Tularemia skin tests were useful for determining the prevalence of infection in this county, and evidence of the risk of tularemia is sufficient to warrant consideration of preventive vaccination of sheepworkers.

RYLANDER, RAGNAR (National Institute of Public Health, Stockholm): ***Revaccination against smallpox. Take and complications. Public Health Reports, Vol. 84, July 1969, pp. 635–638.***

Results from revaccination against smallpox were studied in 1,931 hospital employees given compulsory vaccinations 1964–67 at the Hospital for Infectious Diseases, Stockholm, Sweden. Vaccine with a titer of about $10^{8.1}$ $TCID_{50}$ per milliliter was used for persons who had reacted positively to vaccination within the preceding 5 years. The vaccinator observed and recorded the vaccinee's reaction. Formation of a 1-mm. crusta was considered a positive result.

About 15 percent negative results were obtained with the vaccine with a titer of about $10^{8.1}$ $TCID_{50}$ per milliliter compared with 30 percent negative results obtained with vaccine having a titer of about $10^{7.4}$ $TCID_{50}$ per milliliter. The majority of complications occurred among persons vaccinated with the less potent vaccine and those who had had their last positive reaction to vaccination during childhood.

Use of the more potent vaccine for revaccination of persons vaccinated within 5 years is recommended to decrease the number of negative reactions.

HAHN, HARLAN (University of California): ***Health concerns and attitudes regarding fluoridation. Public Health Reports, Vol. 84, July 1969, pp. 655–659.***

In November 1965 a multistaged area probability sample of 596 Detroit adults was surveyed soon after a major referendum on fluoridation was held in the city. A scale of expressed health concerns was derived from a series of questions relating to personal worries about six serious diseases: lung cancer, tooth decay, heart disease, stomach ulcers, food poisoning, and bone disease. Levels of health concerns were directly and significantly related to positions on an index of dental health information that had been developed from questions about methods of preventing dental caries.

Although expressed health concerns were not directly associated with attitudes on fluoridation, the positions of the respondents on the referendum issue were examined at three socioeconomic levels. Support for fluoridation was inversely related to increasing socioeconomic status. Moreover, persons at low socioeconomic levels with numerous health concerns favored fluoridation, but high-status respondents with strong health concerns were undecided about the issue. Perhaps this relationship was influenced by perceived disagreements about the merits of fluoridation and by different evaluations of the costs and benefits of the program.

LURIA, S. M. (Naval Submarine Medical Center, Groton, Conn.): ***Average age at death of scientists in various specialties. Public Health Reports, Vol. 84, July 1969, pp. 661–664.***

Analysis of the average age at death of scientists whose death notices appeared in *Science* from 1958 to 1968 showed great differences among the various specialties. They range from 76.7 for archeologists to 61.8 for men working with some form of radiation. The average age at death for the sample of 2,224 men was 67.7 years, and for the sample of 93 women, 68.1.

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