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BOOK REVIEWS AND NOTICES

H. P. Miller and R. A. Hornseth, *Present Value of Estimated Lifetime Earnings*, pp. 54, Technical Paper No. 16, Bureau of the Census, Washington, 1967.

One of the first published papers on this subject was "Work Life Expectancy as a Measure of Damages," by Thomas C. Smith and the present reviewer, which appeared in the *Transactions* of the Society of Actuaries (IV, 585). In that paper, tables were constructed specifically for railroad employees from statistics published by the Railroad Retirement Board. Probabilities of death, disability, and retirement, work-life expectancies, and commutation functions at seven rates of interest were presented in that paper, together with illustrations of the application of the tables to measures of damages for wrongful death or injury. The principles expounded in that paper have come to be rather widely accepted by the courts.

The paper under review here—"Present Value of Estimated Lifetime Earnings," by Messrs. Herman P. Miller and Richard A. Hornseth—fulfills a hope expressed in the earlier paper on work-life expectancies that tables for more general application to diverse occupational groups might be developed. As stated by the authors, this paper is intended to meet "the growing demand by the legal profession for information that can be used to help ascertain the pecuniary value of impaired earning capacity." A major portion of the paper consists of tables, developed from empirical data collected by the Bureau of the Census, which present the average dollar amounts of expected lifetime earnings and personal maintenance costs by age, educational level achieved, and color, for each of ten major occupational groups.

The basic formula used to prepare the estimates is as follows:

Present value of future earnings from age A to 64

$$= \sum_{N=A}^{64} \frac{(Y_N - M)P_N(1 + X)^{N-A+1/2}}{(1 + R)^{N-A+1}}$$

The estimated earnings in year of age N , Y_N , were derived from the average annual earnings for each of the age groups 18-24, 25-34, 35-44, 45-54, and 55-64, as shown in the *United States Census of Population, 1960: "Occupation by Earnings and Education"* (Series PC[2]-7B). These averages were assumed to be centered at ages $21\frac{1}{2}$, 30, 40, 50, and 60. Single year of age estimates were obtained by osculatory interpolations in the mid-range of ages 30-50 and by second-degree parabolas for extrapolation from ages 18-29 and 51-64. The report does not present the actual interpolation formulas used; however, it

* Books and other publications noted with an asterisk (*) may be borrowed from the library of the Society of Actuaries under the rules stated in the *Year Book*.

does state that the interpolated values for annual earnings for ages 30, 40, 50, and 60 agree with the reported values to within a half-year of age and that at age 21 the interpolated value agrees to within rounding with the average for ages 18-24. The ages in the tables are given at two-year intervals (even ages).

The basic formula results from four adjustments to a simple summation of the estimated earnings for each year of age from attained age A to age 64.

1. The first adjustment is an allowance for the possibility of death in the year of age N ; i.e., multiplication by the factor P_N , which was developed from the underlying data in *Vital Statistics of the United States, 1964* (Vol. II, Sec. 5, "Life Tables"). This factor represents the relative number of survivors at age N of those alive at age A .

2. The value of earnings in year of age N is discounted at rate of interest R to year of age A for the number of interest years, $N - A + 1$, between ages A and N . ($R = 0, 3, 4$, and 5 per cent.)

3. Annual growth rate of X per cent is applied to the present value of earnings in year of age N to account for the rising productivity occurring over $N - A + \frac{1}{2}$ years between ages A and N . ($X = 0, 2, 3$, and 4 per cent.)

4. Finally, a deduction of yearly maintenance cost of M per year is considered by subtracting M from Y_N for each year of age N . ($M = \$1,000, \$2,000$, and $\$3,000$.)

The resulting formula was split into two parts in order to provide a wider range of combinations for the different values of X , R , and M . The estimates resulting from the first part of the formula,

$$\sum_{N=A}^{64} \frac{Y_N P_N (1+X)^{N-A+1/2}}{(1+R)^{N-A+1}},$$

are presented in Table I for males from ages 18 to 64 by age, education, color, and major occupational group. The estimates resulting from part two of the formula,

$$\sum_{N=A}^{64} \frac{M P_N (1+X)^{N-A+1/2}}{(1+R)^{N-A+1}},$$

are presented in Table II according to the same breakdowns as those for Table I. Excerpts from the tables are given in Table 1.

A basic assumption which has been made in constructing the tables is that retirement will occur uniformly at age 65. Thus there is no allowance for disability and early or postponed retirement. In this respect, as well as in the provision of tables of absolute dollar values rather than commutation functions for relative values, the techniques of this paper differ from those used by Messrs. Smith and Griffin in the earlier study.

The authors of Technical Paper 16 concede a number of limitations of the data, including errors in source data arising from unreliable reporting in the census, probable understatement of income, possible misapplication of educa-

TABLE 1
SAMPLE VALUES FROM TECHNICAL PAPER NO. 16*

AGE	ESTIMATED ANNUAL INCOME	VALUE OF EXPECTED FUTURE LIFETIME EARNINGS (IN THOUSANDS): DISCOUNT RATE OF 4 PER CENT, WITH ANNUAL PRODUCTIVITY INCREASE OF:		
		0 Per Cent	2 Per Cent	4 Per Cent
Total Experienced Civilian Labor Force—All Educational Levels				
20.....	\$ 2,348	\$101	\$146	\$221
30.....	5,287	105	137	186
40.....	6,281	87	106	132
50.....	6,180	59	67	76
60.....	5,703	23	24	25
Total Experienced Civilian Labor Force—Four Years of College				
20.....	\$ 3,107	\$168	\$256	\$406
30.....	7,253	192	260	361
40.....	11,019	181	223	279
50.....	13,365	132	150	171
60.....	13,007	52	55	57

* Occupational tables include the following classifications:

1. Professional and technical workers
2. Farmers and farm managers
3. Managers, officials, and proprietors
4. Clerical workers
5. Sales workers
6. Craftsmen and foremen
7. Operatives
8. Service workers, including household
9. Farm laborers and foremen
10. Laborers, excluding farm and mine

NOTE.—The most significant differential in the results appears to be on the basis of educational level. There is also a significant differential favoring (1) managers, officials, and proprietors, (2) professional and technical workers, and (3) sales workers, in that order.

tional classifications at the younger ages (where, for example, completion of four years of college would not have been possible at certain ages shown in such a table), and so on. The basic tables represent average dollar amounts without reference to the pay rate already achieved by the individual; the results prior to adjustment are therefore averages for all jobs and attainments within the broad occupational classification. Correction can, however, be made by applying to the tabular results the ratio of an individual's earnings to the average for the classification at his age, which average is separately provided.

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SELECT CURRENT BIBLIOGRAPHY

In compiling this list, the Committee on Review has digested only those papers which appear to be of direct interest to members of the Society of Actuaries; in doing so, the Committee offers no opinion on the views which the various articles express. The digested articles will be listed under the following subject-matter classifications: 1—"Actuarial and Other Mathematics, Statistics, Graduation"; 2—"Life Insurance and Annuities"; 3—"Health Insurance"; 4—"Social Security"; 5—"Other Topics."

The review section of the *Journal of the Institute of Actuaries* contains digests in English of articles appearing in foreign actuarial journals.

ACTUARIAL AND OTHER MATHEMATICS, STATISTICS, GRADUATION

J. W. Kuzma, "A Comparison of Two Life Table Methods," *Biometrics*, XXIII (1967), 51-64.

One of the two life-table methods that enters this comparison is attributed to Cutler and Ederer. However, actuaries will recognize it as the classical actuarial mortality-estimation method which is taught to the current generation of students through Gershenson's textbook. The second method is attributed to Chiang and involves an application of the method of maximum likelihood to the estimation of mortality probabilities when it is assumed that the force of mortality is constant on the age interval under study, and that enders leave, on the average, at the mid-point of the age interval.

The first numerical comparison concerns the ratio of the two estimates when the proportion of the group under study that becomes enders varies. Actuaries should be warned that what they call deterministic enders are called withdrawals in this and other biostatistical papers. In the second comparison both the portion of the group under study that becomes enders (withdrawals) and the portion that becomes withdrawals (called those "lost to follow up" in this paper) vary. It is of some comfort to actuaries to see, as might be expected, that when the losses to observation due to ending (withdrawal) and withdrawal (lost to follow up) are small, the two estimation methods produce nearly identical results.

LIFE INSURANCE AND ANNUITIES

*W. M. Mercer and L. E. Coward, *Canadian Handbook of Pension and Welfare Plans*, 3d ed., pp. viii, 360, C.C.H. Canadian Limited, Toronto, 1967.

This third edition of the *Canadian Handbook* has been revised to recognize the many changes which have taken place in the Canadian pension scene in recent years. In particular, new chapters have been added on provincial medical plans, the Canada and Quebec pension plans, and provincial legislation.

In its latest form the *Handbook* is, like the earlier editions, a comprehensive guide to pension and insurance plans in Canada. It will be particularly useful for those who want to be brought up to date on the changes in legislation and taxation of the past few years. While it is directed to personnel officers, union executives, lawyers, and accountants and is written in nontechnical language, it is a thorough review with a useful index and appendixes.

(The first edition of this book was digested in *TSA*, VIII, 111.)

HEALTH INSURANCE

U.S. National Center for Health Statistics, *Hypertension and Hypertensive Heart Disease in Adults, United States, 1960-1962*, pp. 62, Public Health Service Publication No. 1,000, Series 11, No. 13, Washington, May, 1966.

Hypertension is estimated to exist in definite form in 15.3 per cent of the adult population (17.0 million persons) and in borderline form in 14.6 per cent (16.2 million persons). Definite hypertensive heart disease is found in 9.5 per cent of adults (10.5 million persons), and 4.3 per cent (4.8 million persons) have suspect hypertensive heart disease.

The prevalence of definite hypertension rises with increase in age, with the rates for men being greater than those for women in age groups under fifty years. The relationship is reversed at the older ages. The prevalence rates for the Negro population are substantially greater for both sexes in every age group than those for the white population.

Similarly, the prevalence of definite hypertensive heart disease rises sharply with increase in age. At ages over fifty-five women have a higher prevalence rate than men, but this is reversed at the younger ages. Negro men and women have greater prevalence rates in every age group.

The prevalence of hypertension and hypertensive heart disease varies by residence and occupation. With greater education there is a trend toward lower prevalence. Also studied are marital status, industry, family income, and usual activity status.

U.S. National Center for Health Statistics, *Three Views of Hypertension and Heart Disease*, pp. 43, Public Health Service Publication No. 1,000, Series 2, No. 22, Washington, March, 1967.

PREVALENCE RATES OF DEFINITE HYPERTENSION AND DEFINITE HYPERTENSIVE HEART DISEASE FOR WHITE AND NEGRO ADULTS
BY AGE AND SEX, UNITED STATES, 1960-1962

	PER CENT OF SPECIFIED GROUP BY AGE							
	18-24	25-34	35-44	45-54	55-64	65-74	75-79	18-79
	Definite Hypertension							
White men	1.7	3.6	11.8	16.5	20.2	25.0	30.3	12.8
Negro men	1.9	12.5	26.5	30.9	44.6	52.7	59.8	26.7
White women	0.9	2.3	6.2	15.5	30.6	46.6	44.1	15.3
Negro women	3.4	8.6	25.7	41.3	37.9	64.1	69.5	26.6
	Definite Hypertensive Heart Disease							
White men	0.2	1.1	4.0	7.7	11.7	16.3	24.0	6.5
Negro men	1.9	5.2	15.2	24.4	33.1	50.2	32.3	19.1
White women	0.7	2.7	6.8	19.5	37.5	37.1	9.8	
Negro women	1.6	4.7	14.0	31.5	46.4	66.4	69.5	22.2

"Comparison is made between diagnoses of hypertension and heart disease made by the Health Examination Survey and those reported on a self-administered medical history and by the personal physician." The data from the Health Examination Survey are described in Series 11, No. 13, discussed above.

U.S. National Center for Health Statistics, *Age Patterns in Medical Care, Illness, and Disability, United States, July 1963-June 1965*, pp. 84, Public Health Service Publication No. 1,000, Series 10, No. 32, Washington, June, 1966.

"Statistics are presented on the use of medical services and the extent of illness and disability in the population, by age. The primary purpose of this report is to describe the health and care status of persons 65 years and older in comparison with that of the younger segments of the population."

U.S. National Center for Health Statistics, *Childbearing and "Diabetes Mellitus," United States, 1960-1962*, pp. 19, Public Health Service Publication No. 1,000, Series 11, No. 21, Washington, November, 1966.

"The primary concern in this study is with the possibility that the metabolic stresses of continuous pregnancies predispose women to develop diabetes." The question is not resolved by this report, but the available evidence suggests that no such relationship exists.

U.S. National Center for Health Statistics, *Selected Family Characteristics and Health Measures: Reported in the Health Interview Survey*, pp. 26, Public Health Service Publication No. 1,000, Series 3, No. 7, Washington, January, 1967.

Standardized ratios of illness incidence among family groups characterized by size, income, and type are presented adjusted for age, sex, and farm-nonfarm residence.

U.S. National Center for Health Statistics, *Decayed, Missing, and Filled Teeth in Adults, United States, 1960-1962*, pp. 47, Public Health Service Publication No. 1,000, Series 11, No. 23, Washington, February, 1967.

"The number of decayed, missing, and filled (DMF) teeth increased rapidly and steadily with advancing age. At any given age, however, women had slightly more DMF teeth than men of the same race, and white adults had substantially more than Negro adults of the same sex.

"Higher counts of DMF teeth were more frequent among people with greater income or education and among residents of more densely inhabited places. In addition, men and women living in the Northeast had significantly high counts, and those living in the South had significantly low ones."

U.S. National Center for Health Statistics, *Health Characteristics by Geographic Region, Large Metropolitan Areas, and Other Places of Residence, United States, July 1963-June 1965*, Public Health Service Publication No. 1,000, Series 10, No. 36, Washington, April, 1967.

During the two-year period under study, "the average annual number of persons injured in the United States was 53.7 million, or 28.7 persons injured per 100 persons per year. An estimated 394.1 million acute conditions occurred annually, a rate of 2.1 conditions per person per year. . . . 85.7 million persons had one or more chronic diseases or impairments; 22.6 million persons reported some degree of activity limitations. An estimated average of 16.3 days of restricted activity and 6.1 days of bed disability per year were reported. . . . During the 12 months ending June 1964, the

average individual in the civilian noninstitutional population visited a physician an estimated 4.5 times. During the same 1-year period, the average number of dental visits per person in the population was 1.6."

SOCIAL SECURITY

J. M. Ceccarelli, *Vested Benefits*, Actuarial Note No. 33, pp. 3, Social Security Administration, Washington, November, 1966.

This note presents the results of a study in regard to the amount of deferred vested benefits provided by forty-five insured private pension plans which became effective recently. Three tables are presented which show the amount of benefit payable upon normal retirement on the basis of various combinations of level annual salary, years of prior service, and years of participating service under the plan.

OTHER TOPICS

U.S. National Center for Health Statistics, *Blood Glucose Levels in Adults, United States, 1960-1962*, pp. 25, Public Health Service Publication No. 1,000, Series 11, Number 18, Washington, September, 1966.

"This report describes the glucose tolerance test, presents the data collected, and compares the information collected with that of another survey. The relationship of the blood glucose level to the demographic variables of age, race, sex, family income, education, place description, marital status, usual activity status, occupation, and industry are examined.

"The mean blood glucose level rises steadily with age for both sexes; however, the level is consistently slightly higher for women than for men. . . . Among the differentials noted was a strong downward trend of blood glucose levels with higher income and with higher education."

U.S. National Center for Health Statistics, *Employees in Nursing Homes and Personal Care Homes, United States, May-June 1964*, pp. 34, Public Health Service Publication No. 1,000, Series 12, No. 5, Washington, September, 1966, and *Employees in Nursing and Personal Care Homes: Number, Work Experience, Special Training, and Wages, United States, May-June 1964*, pp. 36, Public Health Service Publication No. 1,000, Series 12, No. 6, Washington, January, 1967.

"Employees in nursing and personal care homes are described in terms of their age and sex, job categories, hours worked per week, full-time equivalent staff, and ratio of residents to employees" as well as "their work experience in hospitals, nursing homes, and related facilities; special courses taken that relate to the care of the aged or chronically ill; and wages paid for a standard 40-hour week."

U.S. National Center for Health Statistics, *Variance and Covariance of Life Table Functions Estimated from a Sample of Deaths*, pp. 8, Public Health Service Publication No. 1,000, Series 2, No. 20, Washington, March, 1967.

There is a component of sampling variation associated with observed values when a life table is constructed on the basis of a sample of deaths instead of a complete count. The variance and covariance of functions of abridged and complete life tables based on such a sample are derived in this report.

U.S. National Center for Health Statistics, *Serum Cholesterol Levels of Adults, United States, 1960-1962*, Public Health Service Publication No. 1,000, Series 11, No. 22, March, 1967.

"Mean cholesterol levels rise with age, the rate of increase varying by sex. Corresponding changes occur in the proportion of persons with high serum cholesterol levels. At ages 18-44 years, 3.9 percent of the men and 4.6 percent of the women had levels 260 or more. At ages 45-54, 25.7 percent of the men had such high values; and at ages 65-74 years more than 50 percent of the women did." Also discussed are the problems encountered in standardizing serum cholesterol determinations and the techniques used.

U.S. National Center for Health Statistics, *Chronic Illness among Residents of Nursing and Personal Care Homes, United States, May-June 1964*, pp. 43, Public Health Service Publication No. 1,000, Series 12, No. 7, Washington, March, 1967.

An estimated 554,000 residents with a median age of 80 years are being cared for in 17,400 nursing or personal-care homes. Ninety-six per cent of the residents have one or more chronic conditions or impairments with multiple chronic conditions occurring frequently, the average number for all residents being 3.1 conditions.

U.S. National Center for Health Statistics, *Characteristics of Persons with Impaired Hearing, United States, July 1962-June 1963*, pp. 64, Public Health Service Publication No. 1,000, Series 10, No. 35, Washington, April, 1967.

"A little over 4,000,000 persons were reported to have some loss of hearing in both ears. Among this group, without the use of a hearing aid, 856,000 persons were classified as unable to hear and understand speech; 736,000 were classified as able to hear and understand a few spoken words; and 2,439,000 were classified as able to hear and understand most spoken words. About 22 percent of the population with impaired hearing reported current use of hearing aids."

U.S. National Center for Health Statistics, *Mean Blood Hematocrit of Adults, United States, 1960-1962*, pp. 36, Public Health Service Publication No. 1,000, Series 11, No. 24, Washington, April, 1967.

This report "presents and evaluates blood hematocrit values for the American adult population and discusses the uses and the present norms of hematocrit values." The simplest and most reliable screening procedure for detecting the presence of anemia is the hematocrit determination.