BOOK REVIEWS AND NOTICES

Impairment Study, 1951, pp. 300, compiled and published by the Society of Actuaries, Chicago, Ill., April, 1954.

This publication is an important milestone in the development of insurance for impaired risks. A Committee of the Society of Actuaries, consulting with the Mortality Committee of the Association of Life Insurance Medical Directors, planned and completed this study of impairments based on information contributed by twenty-seven companies in the United States and Canada.

Over 725,000 policies entered into the investigation with an average duration of 6.2 years—greater than in any previous study of impaired lives. The total number of deaths in all classifications was 18,317.

In general, policies issued from 1935 to 1949 were studied to anniversaries in 1950. However, the rapid progress of medical science over this period led to further subdivisions in some groups. Only policies issued at ages 15 to 64 on lives resident in the United States and Canada which had been medically examined were included. The usual treatment of minor impairments was followed. Policies issued at standard rates were studied separately from those issued at substandard rates. The study was by number of policies, but the number of lives terminated by death is also shown to aid in the interpretation of results.

Basic tables based on the intercompany annual mortality studies were constructed to fit the periods involved. While these tables are based on amounts of insurance, tests indicated no adjustments were needed to allow for the fact that the impaired classes were studied by number of policies.

Information as to causes of death was gathered from eleven of the large companies and served as a basis for determining those causes which were unusually prominent in a particular impairment group.

The impaired classes were studied under nine major headings and the results summarized in a conveniently condensed form. The discussion of each class describes: (1) the extent and nature of the data; (2) the significant over-all mortality characteristics; (3) the features of mortality by age and duration; (4) the significant facts with respect to the causes of death; and (5) results of other studies which are pertinent, particularly the findings in previous Impairment Studies.

Detailed tables give the experience by age groups and durations, and show leading causes of death and other facts where there is a significant volume.

The introduction points out several limitations in interpreting the results of the study and indicates other considerations which must be kept in mind if the study is to be used for medical or public health purposes. In addition, the detailed explanations cite some of the factors to be considered in weighing the question of whether the results can be accepted at face value or not. In doing so, the

Committee has warned about pitfalls which would otherwise have led the unwary into making many mistakes.

No attempt is made in this review to enumerate all the significant findings brought out in the study. These are covered more adequately in the report of the panel discussions contained elsewhere in this volume. This study will undoubtedly result in many changes in practice with respect to the insuring of medically impaired lives.

PEARCE SHEPHERD

D. W. A. Donald, *Compound Interest and Annuities-Certain*, pp. 300, Cambridge Press, Cambridge, 1953.

Edwin F. W. Sumner, *Practical Compound Interest*, pp. 176, Financial Publications, Ltd., Auckland, N.Z., 1953.

These two books by actuaries on the same general subject have surprisingly little in common. Both were written and published in the British Commonwealth and make use of the British monetary system; both books contain numerous worked examples and both offer too few exercises for the reader to practice on. From this point on, it is their differences which are most striking. Thus, Donald's book contains 277 pages of actual text while Sumner's has only 84. The former book, sponsored by the Institute of Actuaries and the Faculty of Actuaries, is definitely a textbook written for the actuarial student and designed to give him both an understanding of theory and an ability to solve problems. Sumner, on the other hand, says in his Foreword: "As may be seen, the book is not a treatise but a handbook involving no 'higher mathematics' and prepared for the use of Banks. . . ." Donald makes much use of the infinitesimal calculus and calculus of finite differences while Sumner sedulously avoids both.

The book by Donald covers essentially the same material as did its predecessor, the well-known textbook by Todhunter which first appeared in 1901. The author states in the Preface: "My indebtedness to Todhunter is obvious." A comparison of the books bears this out. The order of topics in each is the same with the exception that in the older book continuous annuities and various other applications of the calculus are concentrated in one chapter near the end. However, Donald's book is much more than a rehash. The author's exposition is remarkable for its preciseness and clarity, particularly in the early chapters. Perhaps the book could best be described as a "teachable Todhunter."

The first two chapters provide the clearest and most logical and consistent introduction to compound interest that this reviewer has read. By pointing out that interest and discount are merely different ways of looking at exactly the same thing and by basing the theory primarily upon the instantaneous rate notion, using the force of interest, the author is able to bring about a unity in the theory that is both intuitively and mathematically satisfying. The use of continuous functions and the calculus are prominent features of this book and contribute much to its clarity and completeness.

At the end of each chapter after the first are numerous worked examples

which amplify the exposition and should be of real assistance to students, especially those studying on their own without a teacher. A limited assortment of exercises accompanies each chapter. While these appear to be well selected, it is the reviewer's opinion that the typical actuarial student would do well also to have at hand a standard college text on the mathematics of investment to provide more exercises.

Not all of the chapters are as clearly written and as helpful to the American student as are the early ones. Thus, Chapters 6 and 10, Capital Redemption Policies and Income Tax, respectively, contain much that is peculiar to British conditions and of comparatively little interest here. For American usage it would have been better had the useful sinking fund topics of Chapter 6 been integrated with much of the material of Chapter 9, Cumulative Sinking Funds.

Chapters 7 and 8 on Valuation of Securities may not be too easily comprehensible to American students. The author occasionally uses terminology and refers to practices which are essentially British and which differ somewhat from their counterparts here. Donald follows Todhunter in relying almost entirely upon Makeham's bond valuation formula, the simplicity of which is more apparent than real. While it cannot be denied that this formula has advantages especially in certain more complicated problems and hence must be mastered by the actuarial student, the more usual simpler problems might best be handled by the conventional approach. Perhaps the author felt that it was better pedagogy to concentrate upon only one method which would cover all kinds of cases.

Sumner, too, follows the Todhunter order of topics quite closely. He adheres rather strictly to his announced intention of producing a handbook, not a treatise. His mathematical methods are elementary, yet the exposition is so abbreviated that it is doubtful whether this book would be as readily understood by the beginning student as the more rigorous and advanced exposition of Donald.

Both books follow Todhunter in winding up with a chapter devoted largely to instructions on the calculation of interest tables. The advice itself is sound, but the advent of modern punched-card equipment and the new electronic digital computers probably make the described methods largely obsolete.

Both books list answers to the exercises in the pages immediately preceding the tables. Donald's book contains a fairly brief index; Sumner's has none. Donald's tables are quite abbreviated, listing only 15 rates of interest ranging from $\frac{1}{2}\%$ to 5% for values of n by units to 50 and every tenth value thereafter to 100. Five interest functions, including the reciprocal of the annuity, are shown, in some cases to five and in others to six significant figures. Sumner's tables present 43 different interest rates from 1% to 10% for values of n ranging by units to 100 for rates through 4% and to 50 for higher rates. Only the basic four functions are given and these uniformly to six decimal places. Various auxiliary tables are also shown. The last page in the table will be most helpful to American students since it shows decimal parts of a pound by shillings and pence.

In summary it might be said that the book by Donald will be a most welcome substitute for Todhunter's textbook. The Education and Examination Com-

mittee is to be commended for having placed this book in the syllabus so promptly. One can now hope for the ultimate appearance of another text on compound interest which will combine the clarity and precision of Donald and the terminology and methods most familiar to American actuaries.

CARL H. FISCHER

C. L. Dearing, *Industrial Pensions*, pp. x, 310, The Brookings Institution, Washington, 1954.

The subject of this book is important not only to those close to the industrial pension movement in this country but also to those who may think they have little or no connection with such movement. While there may not necessarily be agreement with the author's conclusions and recommendations, a reading of the book will stimulate a broader perspective and an appreciation that the healthy development of industrial pensions is a matter of concern to all.

The scope of the book can be most concisely stated by quoting from its Introduction as follows:

The first three chapters explore the social and economic problems of an aging population and describe the traditional division of responsibility for their solution. The next three chapters analyze the main forces that have recently accelerated the growth of industrial pensions, describe the structure and operation of those programs, and present an estimate of the number of industrial workers who may eventually be covered into the pension system, together with an estimate of the amount of money that may be set aside annually in trust funds or insurance companies to support such a program.

The remainder of the study is devoted to an evaluation of the basic economic and social issues that may be expected to arise if the industrial pension program develops along the lines indicated by preceding analysis. Consideration is given to such questions as: (1) Will it be possible to find productive outlets for the anticipated accumulation of funds in trust and insurance companies and other financial agencies? (2) What chance do the workers who are technically covered by pension plans have for actually receiving the promised benefits? (3) How should industrial pensions be related to the federal social security program? (4) Are pension benefits a proper subject for mandatory collective bargaining? (5) Should industry pay the full cost or should the worker contribute? The final chapter suggests some of the elements of sound pension planning that contrast sharply with existing programs. Unless these minimum requirements are met there is danger of ultimate disillusionment for the potential beneficiaries and excessive damage to the economy.

The first three chapters provide useful background material. As to the pre-1949 developments in Chapter III, the reviewer, as one who has lived with the group annuity movement since its inception, believes that more could have been told of the influence of the life insurance companies in the 30's and 40's. It is not without significance that the two plans cited in Chapter IX as being "in the main free of . . . undesirable features" were plans covered by group deferred annuity contracts issued during the pre-1949 period.

Chapter IV provides an excellent account of the main forces in recent industrial pension developments. Chapter V, The Structure and Operation of Pension

Plans, presents a useful description of two broad groups of plans: "single company" and "pooled welfare" plans. The reader will be impressed by the weaknesses and problems involved in pooled or multi-employer plans. As to vesting, the account does not bring out the fact that vesting of benefits before retirement is much more prevalent among insured plans than noninsured. The author, in discussing insurance company contracts, fails to recognize the universal provision for sharing in surplus earnings of the insurance company. This is a serious oversight.

The estimate of present and probable coverage under industrial pension plans, based upon an industry survey arranged through the Controller's Institute of America, has been carefully done. It is estimated that 22 million workers will "be participating in one degree or another in industrial pension plans by 1960" or about 30% of the 1960 work-force. In Great Britain in 1951,* private industrial pension schemes covered one-third of gainfully occupied men below age 65 and one-fifth of gainfully occupied women below 60.

In Chapter VII, the amount and nature of pension contributions are studied on the basis of statistical data from the industry survey to which 297 corporations employing 3.9 million workers contributed. An extensive analysis led to the conclusion that, by 1960, contributions to support industrial pensions will add about $6 billion annually to the supply of individual money savings seeking profitable investment outlets. As to influences affecting the magnitude of contributions, mention should have been made of the fact that the generally more prudent actuarial assumptions used under insurance company contracts tend to produce a higher average contribution for a given scale of benefits. A table in this chapter classifies contributions reported in the questionnaire by method of financing. It shows that 25% were insured, 42% were placed with a trust company, 29% were invested internally (principally private trust) and for 4% the financing was not known. These percentages reflect only the response from the questionnaire and do not necessarily indicate the distribution for all plans in this country.

Chapter VIII, The Investment of Pension Funds, deals with an issue that is important to any one concerned about the effective and productive investment of savings. In the author's words, "If these savings ($6 billion annually by 1960) can be productively invested so that the return will support the pensioners and the additional national product to supply their needs, it may be possible to carry the pension load without throwing the burden upon the younger generation." The author estimates that by 1960 total new money savings will be $18 to $22 billion annually compared with estimated maximum potential outlets for new capital of $17 to $18 billion per year. The reviewer, not feeling qualified to discuss this feature, asked an investment officer of the Equitable Life, Second Vice President A. W. Gilbart, to comment on this Chapter. Agreeing with the author's economic premise as to the need for productivity, Mr. Gilbart observes:

* F. W. Bacon, B. Benjamin, and M. D. W. Elphinstone, *The Growth of Pension Rights and Their Impact on the National Economy*, a Study prepared for the Institute of Actuaries and the Faculty of Actuaries, 1954.

Future demands for funds for public educational facilities, urban development, highways, housing, productive facilities and transportation are examined at some length. However, discussion of the impact of technological improvements, the development of new products and services including improved mass distribution of goods, the emergence of new industries (such as those to be built around atomic energy) and changes in American living patterns (expansion of suburban areas, increased leisure, etc.) appears to be somewhat inadequate in view of the fact that similar developments in the past have been a major factor in the demand for funds. Accordingly, the conclusion that $17 to $18 billion represents the maximum demand for investment funds during the 1960's is overly pessimistic in the light of the basic assumption that our dynamic and expanding economy would continue throughout that period. . . .

Regardless of how accurately the author has projected a gap between supply and demand for funds, it is my personal belief that any gap which may occur will be quickly closed by the demonstrated ability of the American entrepreneur to use available funds to the advantage of both himself and the entire nation. Our capitalistic economy has enabled us to enjoy a constantly rising standard of living and to meet our human demands and aspirations this standard must continue to rise. The proper use of investment funds will play an important part in improving future living standards and it would appear that an undersupply of savings is more to be feared than the oversupply expected by the author.

It will be of great interest to compare the author's prognostications as to future capital supply and demand with the study now under way by the National Bureau of Economic Research. This study, *Capital Formation and Finance*, which is being made under a grant by the Life Insurance Association of America, is directed by Professor Simon Kuznets; it is expected to appear within a year.

In Chapter IX, the author offers an appraisal of present industrial pension plans and his idea of sound plan characteristics. A plan "free of undesirable features" would provide for employee contributions, liberal vesting, benefit based on current earnings and not a direct function of OASI benefits. He believes there is "a need for clarification and restatement of certain concepts and statutory standards that have materially influenced industrial pension developments." This is a provocative chapter.

The final chapter deals with the vital issue as to how the responsibility for pension financing should be allocated. He accepts the principle that the federal government's responsibility should be limited to providing a floor of protection and that it "can not and should not provide a substitute for individual or collective private efforts to realize a level of living in old age adapted to individual circumstances and preferences." He seems to depart from this idea when he states that "if special pensions for past service are considered necessary or desirable, equity would be served by having society assume this responsibility rather than by imposing the obligation on the current employer of those nearing retirement." OASI does this in part now. The suggestion is otherwise completely impracticable. Going all the way on the deferred wage theory, the author would require the employer to bargain as to "future service" pension credits, the pension agreement providing "that a portion of wages or wage increases secured through collective bargaining would be used to buy old-age security." Money

equities so established would be completely vested and the workers would have full responsibility for pension management. The idea is confused by the further recommendation that the "individual workers should have unfettered choice in deciding whether to take any enhancement in compensation secured through collective bargaining in the form of take-home pay or to devote some portion of this amount to the orderly purchase of a retirement income." Prime responsibility would rest on the individual, operating unilaterally or collectively, for providing retirement income beyond OASI.

This proposal has serious weaknesses. The initial choice of cash or pension contribution will likely result in the acceptance of cash by most employees, thus dissipating the pension contribution. Also, the concept of a money equity in dollars owned by the employee will probably necessitate its return at death before retirement and options at retirement, freely elected, of various annuity forms or lump sum—features which can greatly increase pension costs.

The present situation where industrial management takes primary responsibility for developing and paying for industrial pensions has advantages that should not be lost. Competition for able employees necessitates a pension program. A vital factor encouraging the funding of benefits in advance of retirement, among other compelling forces, is the tax-exempt earnings of pension funds for qualified plans. A given rate of tax-free income is the equivalent of a much higher gross rate of taxable return on working capital. The employers' vital concern with pension costs stimulates a real interest in the yield on investments and, whether the funds are with a trustee or insurance company, there is an incentive to seek good yielding productive investments with due regard for safety of principal. This situation should encourage a flow of pension funds into productive channels. In contrast, where there is individual or collective employee responsibility, there will be great inclination to play it safe—to invest only in "governments" or triple-A bonds. Finally, the responsibility currently carried by industrial management provides a form of enlightened paternalism which conserves funds solely for pension purposes. This asset should be preserved.

Although we share the author's concern about the "unrelenting pressure to issue more claims to future income than can be supported" by prospective increased production, we must keep in mind the dominating position of claims established by governmental legislation. In 1953,* pension payments under OASI were $3 billion, under various veterans' pension programs they were $2½ billion, and other government pension programs (railroad retirement, state and municipal) came to $1½ billion. These compare with payments under private industrial plans of an estimated $0.6 billion. Estimates for 1960 are $1.2 billion for private pension plans out of a total of $15.2 billion! Claims created by legislative action, state or federal, with no necessarily related provision for increased productivity, are in considerable contrast to claims established under well-funded industrial

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* "Pension Payments—A Stabilizing Influence," Miriam Civic; paper presented to American Statistical Association, September 10, 1954.

pension plans set up by a cost-conscious industrial management which will very likely, and almost automatically, provide the increase in capital funds needed to support the required increase in productivity. The greatest danger to our economy rests in the undue expansion of governmental programs!

RAY M. PETERSON

F. W. Bacon, B. Benjamin, and M. D. W. Elphinstone, *The Growth of Pension Rights and Their Impact on the National Economy*, a Study prepared for the Institute of Actuaries and the Faculty of Actuaries, pp. 62, 1954.

In January 1952 the Councils of the Institute of Actuaries and the Faculty of Actuaries in Scotland, having in mind the widespread feeling that the growth of pension commitments in relation to the national income is a matter of major public policy, decided to invite a small research group to prepare a study of the subject.

This 62-page booklet represents the completed study. Its terms of reference were as follows, directed, of course, to the situation in Great Britain:

To prepare a study of the impact of pension payments on the national economy, with particular reference to the following matters:

The financial and economic effects of pension rights of all kinds (under National Insurance, Civil Service and Local Government schemes, schemes for nationalized industries and under private schemes, both by private funds and with Life Offices) having regard to the future population trends in the United Kingdom and, in particular, the growing number of aged persons in the population over the next few decades.

The relation between the trend of productivity and the growth of pension rights.

The financial and economic effects of funding and assessmentism.

Interest in these matters appears to be growing in Great Britain; since this study was started, the Chancellor of the Exchequer has set up a committee with very similar terms of reference.

Concern on these matters of the impact, present and future, and in various directions, of pension benefits, costs and funds is not peculiar to Great Britain; in our country we see more and more of this concern. For example, another book, *Industrial Pensions*, by C. L. Dearing of the Brookings Institution, also reviewed in this issue of the *Transactions*, attempts to cover some of the same ground for the United States. We see studies on the number of persons covered by private plans, the current and future costs, the trend of disbursements, the growth of the funds, their investment problems, their ultimate size, discussions of their deflationary or opposite effects, and of the question whether employers should fund rapidly or slowly, etc. We see limitless debate on our Social Security (OASI) benefits, taxes and reserve fund. Will the benefits really be paid; if so, in what kind of dollars? Will the taxes go "through" the roof? Do we need a huge reserve? Isn't it full only of I.O.U.'s? With respect to both private and governmental plans, we see much discussion of transfer payments to nonproducers, particularly to the growing category of the aged. Will our future producers be willing to see a larger and larger dollar amount of the results of their labors be

routed to the nonproducers, particularly the aged ex-producers? Will our pro-
ductivity increase to meet this load and to prevent a larger and larger *proportion*
being thus routed? To what extent can these transfer payments be allowed on a
tax-free basis? (We have just seen, in the 1954 Tax Law, a tremendous advan-
tage given the aged; what are the implications in this for the future?)

This reviewer has recited these kinds of questions, being raised in the United
States, as indicative of what this British study seeks answers for. The study is
not easy reading—not that it is poorly written (quite the contrary)—because it
deals with complicated elements and projections.

The study analyzes the British population by age and concludes that a stable
(life table) condition may be reached in 20 years so that the present growth in
the proportion of the aged is not an abnormal trend *from* a stable condition but
a normal trend from previous unduly small proportions of the aged.

The study examines the burden of dependency (mainly the aged, children,
nonemployed females under age 60), pointing out that nonproducers have been
taken care of in the past and, almost assuredly, will be in the future, the ques-
tion being, perhaps, how well and how soundly "taken care of." On this point,
however, the study brings out an interesting conclusion—while there has been
a rise in the burden in respect of the aged, there has been a fall in the burden
for children so that the net burden today is not much different from its status
in the early 1920's. The authors feel that for the next 25 years (*i.e.*, to the point
of stability) the aged burden will increase 50% but that $\frac{1}{2}$ of this will be offset
by savings in the child burden, or a net increase, for the two categories, of 25%.
When this increase is diluted further by averaging in an effect of "no changes"
in respect of the female dependency category, the net increase for the next 25
years is less than 10%, certainly not alarming. Furthermore, for the aged alone,
the authors feel that the proportion of the burden is now only $\frac{1}{4}$ and by 1977 will
not be more than $\frac{1}{3}$. (These would be interesting figures to work out for our
country.)

The study goes on to examine the various pension plans set up in Great Brit-
ain, the aggregate contributions, pension outgo and accumulated funds. The
authors relate these to the national income, try to evaluate the future growth
of pensions and its effect on general living standards. They extrapolate the trend
of productivity and relate the increase to the growing pension burden. They
reach the important conclusion that productivity growth "should permit of a
substantial increase in the standard of living of the active population, in spite
of the growth in the numbers and the claims of the old people," although they
are quick to point to the caveat that this assumes the terms of British trade will
continue as favorable as in 1952. On the other hand, if defense expenditures can
be curtailed, the released productivity could be applied toward meeting the
burden of transfer payments and the standard of living.

Concerning the funding of pension schemes, the authors find an encourage-
ment in the tax relief afforded (which, however, is not a "dead loss" to the gov-
ernment as some of it becomes taxable later on). This funding is probably not

deflationary since it is offset, the authors suggest, by a reduction in saving in other directions. (It is doubtful if such an offset has been demonstrated in the U.S. as yet.) Furthermore, at some long-future date, the growth in the funding would cease. The authors find that funding of private plans has compelling reasons but that these reasons become more and more tenuous as the focus is moved to the local government field and then to the national government fields of Civil Service pensions and the National Insurance Scheme (our "Social Security"). Particularly in the latter, the authors find a blurred distinction, if any, between reserve funding and assessmentism (our pay-as-you-go).

There is much more in the study which cannot be covered in a brief review. A few interesting random points may be jotted down.

a) In the early 1950's the number of private pension plans was about 5,000 covering some 2½ million persons; in both instances somewhat more than half are of the insured type.

b) The average annual contribution per employee was around £40, perhaps 70% employer (including past service) and 30% employee. (Contributory schemes are rather the rule there, encouraged by the different tax treatment from here.)

c) The funds held for noninsured plans earned a little over 3½% interest for the year 1951.

d) These funds are now some £900 million and may ultimately reach £2 billion.

e) From 1947 to 1951 productivity increased at an annual rate of 3%; in their lower set of projections, the authors assumed a rate of 1½%.

f) The authors deal at length with the subject of late or mandatorily deferred retirements. They conclude that this would provide less increase in productivity than is generally believed and only a small savings in cost. (This is contrary to many statements made in this country but both viewpoints are correct, I believe, in that late retirement in Great Britain is seen as enjoying an actuarial increase in the later pension, while here it is customary in most plans not to so increase the later pension.)

g) As noted earlier, the authors have placed in the dependency base the nonemployed females, including housewives, and have envisioned this category as a potential source of increased productivity, *i.e.*, by getting more females into gainful work. This reviewer does not accept the housewife as a nonproducer, at least until we get fully push-button homes (and we are nearer to that now than is Great Britain). Since it is this female category which dilutes so greatly the authors' figures on increase in burden, I feel their results of the increasing burden are underestimated.

The authors naturally are writing more in a "welfare state" milieu than yet obtains here. Very little weight is given individual savings, investment and thrift channels for lowering the dependency burden. National planning and pump-priming are referred to without shudders.

This study is a provocative work, done with great skill and appreciation of the many facets and ramifications involved. This is not to say that another study group with equal skill would fully confirm these findings. All dealings in futures are tenuous. Work, productivity, leisure may take on entirely different attributes over future decades as our electronic brains, push-button factories, atomic power, etc., change the meaning of "dependency" and "nonproducers."

<div align="right">DORRANCE C. BRONSON</div>

The a(55) Tables for Annuitants, published for the Institute of Actuaries and the
Faculty of Actuaries, pp. xxxii, 285, Cambridge University Press, 1953.

This book is the British counterpart of the book of actuarial functions based
on the *a*–1949 Table and projected annuity tables, published by the Society a
year earlier. There are a number of similarities between the two books; also
some important differences.

The *a*(55) book includes, first, a 22-page preface explaining how the tables
were constructed, and indicating how they can be used. Then there are 52 pages
of single life functions and 184 pages of joint life tables for the single-entry *a*(55)
Table itself. Finally, there are 32 pages devoted to a double-entry set of six gen-
eration tables. The single life functions are shown for twelve rates of interest
from 2% to 6%, and the joint life functions mostly for seven interest rates.
Tables of joint annuities and last survivor annuities are lengthy even though
they are considerably abbreviated by use of only alternate, or in some cases
quinquennial, ages.

This book was prepared under the direction of the joint committee of the
Institute and Faculty responsible for the British continuous mortality investi-
gations. The current mortality data were contributed by 47 life insurance com-
panies. These data and the whole problem of annuitant mortality were the sub-
ject of a memorandum which was discussed at sessions of the Institute and
Faculty late in 1951 and reported in *JIA* LXXVIII, 27 and *TFA*, XX, 263.

Most of the fundamental assumptions underlying the *a*(55) Tables are the
same as those upon which the *a*–1949 Tables were based, viz.:

(1) That the death rate at each attained age decreases in a geometric progression with
    the passage of time.
(2) That the annual progression factors decrease with increasing attained age and are
    the same for both sexes.
(3) That these factors are applied to a base-year mortality table of the conventional
    kind, without ultimate limits of the type assumed for the $a(m)$ and $a(f)$ projections.

However, one basic assumption differs. For the *a*–1949 Table there was first in-
jected a "current" factor of safety before the projections for possible future
mortality decreases. The British procedures omitted this provision.

The similarities between the structures of the two sets of tables are, on the
other hand, very few. The *a*(55) Table itself is single-entry in the conventional
form, but is calculated so as to be appropriate, on the average, for immediate
annuities issued in the year 1955. In preparing this table, average ages were
used, following the method adopted in constructing the $a(m)$ and $a(f)$ tables.
There is shown for the *a*(55) Table a table of additions to the annuity values,
appropriate for 1965 issues of nonrefund annuities. It is remarked that pro-rata
adjustments are suitable for issues in other years, but there is relatively little
discussion of appropriate ways and means of adjusting the values for other
types of annuities.

The set of six generation tables exhibits values of q_x and a_x for birth years
1885, 1895, . . . , 1935.

The *a*(55) Tables assume that each year the value of q_x at each age is (2.16 —

.02 × age)% less than the value at the same age in the next previous year. This results in the following illustrative rates of decrease, as compared with the a–1949 Table Scale B rates:

ATTAINED AGE	ANNUAL RATES OF DECREASE	
	a(55)	a-1949
50..............	1.16%	1.25%
60..............	.96	1.20
70..............	.76	.95
80..............	.56	.50

These British projection factors were derived from the 1863–93, 1900–20, and recent continuous British offices experiences for females. The less rapid improvement indicated by these experiences for males was disregarded as perhaps dangerous as an assumption for the future.

The British base-year table was applicable to 1947, and compares with the American 1943 Experience Table as follows:

ATTAINED AGE	1,000q_x (ULTIMATE)			
	MALES		FEMALES	
	British	American	British	American
50.........	6.16	7.99	4.90	4.04
60.........	16.70	19.01	11.17	9.17
70.........	44.81	39.76	27.07	24.73
80.........	112.03	92.70	73.51	68.93

Typical nonrefund life annuity values at $2\frac{1}{2}$% interest, based on the ultimate a(55) and a–1949 Tables for 1955 issues, are as follows:

AGE	MALES		FEMALES	
	a(55)	a-1949	a(55)	a-1949
50.............	18.0	18.8	20.1	21.1
60.............	13.4	14.3	15.6	16.4
70.............	8.8	9.6	10.8	11.3
80.............	5.0	5.6	6.5	6.5

Graduation of the a(55) Tables was by the Perks formula:

$$q_x = (A + B\,c^x) \div (1 + D\,c^x)$$

The single-entry table has a one-year select period, while that of the six generation tables is five years.

One of the difficult problems faced in the construction of the $a(55)$ Tables was the shortage of annuitant data at the younger ages. As a result, this part of the tables is to a large degree empirical, and no figures are shown for ages under 20 in the single-entry table, or under 40 in the generation tables.

WILMER A. JENKINS

D. McCahan, ed., *Accident and Sickness Insurance*, pp. xvi, 334, University of Pennsylvania Press, Philadelphia, 1954.

This book contains a series of lectures given under the auspices of the S. S. Huebner Foundation at the University of Pennsylvania. There are thirteen lectures in all, each written by an outstanding actuary or expert in the Accident and Sickness Insurance business. The authors are: Messrs. Edison L. Bowers, E. J. Faulkner, C. Manton Eddy, Gilbert W. Fitzhugh, J. Henry Smith, H. Lewis Rietz, Wendell Milliman, Armand Sommer, Alfred W. Perkins, Edward A. Green, John H. Miller, Edward M. Neumann, and J. F. Follmann, Jr. Throughout the volume, there is an exceptionally clear and simple presentation of the many facets of the Accident and Sickness business. Excellent background and historical material is presented in the chapters on Meeting Hospital Costs and on Meeting Surgical and Medical Expense, and also in the chapters on Regulation of Accident and Sickness Insurance.

Practically all the technical problems that arise in the conduct of the Accident and Sickness business are touched upon, including underwriting, claims, contracts, rates and reserves. Wherever the problems differ materially between personal and group insurance, a separate chapter is devoted to each. On the subject of underwriting, reinsurance and claims, a further distinction is made, with separate chapters for personal commercial contracts and for personal noncancelable contracts. This separation of ideas adds greatly to the clarity of the book. In spite of its diverse authorship, there is very little, if any, duplication of subject matter. Much useful reference material is found in the appendixes.

This book will provide excellent introductory material to actuarial students and others seeking background information in this field. It is not designed as a text to furnish students specific answers to practical problems encountered every day in the insurance business.

ALAN M. THALER

The Registrar General's Decennial Supplement, England and Wales, *1951 Occupational Mortality, Part I*, pp. iv, 75, H. M. Stationery Office, London, 1954.

England and Wales began their long series of occupational mortality studies of the general population in 1851. The first study of social class mortality, in which the social classes were formed by grouping specific occupations, was made for the three-year period centering about the 1911 census and has been repeated at subsequent censuses. Customarily, these analyses have been based upon the entire body of census returns and the published results were not ready for sev-

eral years. The present report is preliminary, being based upon deaths in 1950 and a one-percent sample of the 1951 census; results are presented for social class groupings and for only a few major occupations. Although there is loss in accuracy inherent in the sampling process and the scope of the study is restricted, there is the advantage that an insight into mortality trends is available at an earlier date.

The five social classes which have been distinguished are:

Class I—Professional, etc., occupations
Class II—Intermediate occupations
Class III—Skilled occupations
Class IV—Partly skilled occupations
Class V—Unskilled occupations

Classes III, IV and V have been further subdivided into a number of large functional subdivisions. The results are set forth in the form of Standardized Mortality Ratios which are analogous to the ratio of actual to expected deaths. Similar calculations in the earlier studies permit examination of mortality trends.

There is an obvious implication that the several specific occupations assigned to a particular social class will have certain environmental influences in common which will produce similar levels and trends of mortality. It is inevitable, however, that in a social class grouping with so few titles there will be considerable diversity among the components. This is evident in the ratios developed for some of the subdivisions of the classes. This heterogeneity within the social classes may account, in considerable degree, for changing relationships among them.

TABLE 1

STANDARDIZED MORTALITY RATIOS OF MEN AGED 20–64

YEARS	SOCIAL CLASSES					ALL OCCU-PIED AND RETIRED
	I	II	III	IV	V	
1921–23........	82	94	95	101	125	100
1930–32........	90	94	97	102	111	100
1950..........	97	86	102	94	118	100

Table 1 shows a consistent upward gradient in mortality from Class I to Class V in the two earlier studies. The current study gives evidence of a reorientation of social class mortality, since the two lowest levels of mortality are found in Classes II and IV. The reasons for this shift are not evident and further consideration of the problem is withheld pending the more comprehensive report based on deaths for 1949–53.

Following the pattern of the study of 1930–32, an analysis was made of the mortality of married women and infants, and of maternal mortality according to the social class to which the occupation of the husband or father is assigned. By this procedure, it is possible to study the effect upon mortality of the mode

of life associated with occupation apart from the direct exposure to occupational health hazards. In 1930–32, the upward progression of mortality from Social Class I to Social Class V observed among men was also found among their wives, thus indicating that social class variations in mortality are largely a product of environment. This pattern was also observed in 1950, with the exception that wives in Class II now show the lowest mortality.

TABLE 2

STANDARDIZED MORTALITY RATIOS OF MAR-
RIED WOMEN AGED 20–64

| Years | Social Classes | | | | | All Married Women |
	I	II	III	IV	V	
1930–32.......	81	89	99	103	113	100
1950..........	96	84	101	104	117	100

TABLE 3

NEONATAL AND POSTNEONATAL MORTALITY RATES
PER 1,000 LIVE BIRTHS

| Age at Death and Year | Social Classes | | | | | All Classes |
	I	II	III	IV	V	
Under 4 weeks						
1930–32......	21.7	27.2	29.4	31.9	32.5	30.2
1950.........	12.9	16.2	17.6	19.8	21.9	18.1
4 Weeks—1 Year						
1930–32......	11.0	17.8	28.2	34.9	44.6	31.4
1950.........	4.9	6.0	10.5	13.9	18.8	11.2

In 1930–32 the excess mortality of men as compared with women was from 54 percent in Social Class I to 36 percent in Social Class V. In 1950, as the result of a larger improvement among women, the excess mortality of men was about 80 per cent in each social class except Social Class IV, where it was 56 percent.

Several causes of death show an association with social class. Among those which give evidence of a rising gradient of mortality from Social Class I to V for both men and women are respiratory tuberculosis, pneumonia, syphilis, rheumatic heart disease and myocardial degeneration. The only cause in which the gradient was downward from Social Class I to V for both sexes was leukemia. For men only, such a downward gradient appeared for coronary heart disease, hypertension and vascular lesions of the central nervous system.

The effect of social class upon neonatal and postneonatal infant mortality is shown in Table 3, where the rates for 1950 and 1930–32 are compared.

Although the number of maternal deaths was too limited for reliability, a fairly definite social class upward gradient from Social Class I to Class V emerges. Maternal mortality has been reduced by about 80 percent in each of the social classes in the period between 1930–32 and 1950.

D. J. VAN KEUREN

H. H. Wolfenden, *Population Statistics and Their Compilation*, pp. xxiii, 258, The Society of Actuaries, Chicago, 1954.

In the period of almost three decades that have elapsed since the first edition of this book, published by the Actuarial Society of America in 1925, the field of demography has expanded greatly. Not only has there been a great improvement in the amount and extent of statistics available, but there have also been many new developments in method. This book covers only that part of the field of demography which is of most interest to actuaries and is susceptible to actuarial techniques, namely census data, vital statistics data, and the application of statistical and actuarial methods to their study.

This book is a unique combination of an extensive reference and research source for demographers and a textbook for advanced students in demography. Although written to some extent from an actuarial point of view, its use is by no means limited to actuaries. Rather, the general student of demography can obtain an excellent survey of the collection, statistical processing, and use of population statistics, particularly those dealing with mortality and the development of life tables. The practicing demographer who must prepare life tables or make extensive use of existing life tables is unlikely to find elsewhere such an exhaustive treatment of this aspect of population statistics. Thus, the author deals at great length, and with a wealth of references, with work that has been done throughout the world on the errors in census and registration statistics, how to adjust for them, and then how to construct mortality tables from these data. Probably the principal feature of this book is the lucid description of the research and methods developed over a period of many years by individuals in various countries. Thus, no single method is advocated for doing a particular job, but rather a wide variety of methods is presented, and the reader may select those that appear to be appropriate, or applicable, to the problem with which he is dealing.

The book is divided into 16 sections, along with a 22-page appendix, "Some Theories in Sampling of Human Populations," by Dr. W. Edwards Deming. The sections are further subdivided into paragraphs and in some cases subparagraphs. As an editorial matter, the criticism might be offered that there is no index and that, although the table of contents is quite adequate in describing the subjects dealt with, it is rather inconvenient that no page references are given. Rather the book must be thumbed through to find the desired paragraph.

Section I is a relatively brief statement of the purpose of the book and the portion of the demographic field which is dealt with. Section II deals succinctly with the fundamentals of the census, namely, the history of census taking and the general ways in which various censuses are taken, as well as a listing of censuses in various countries throughout the world. Section III correspondingly

deals with the parallel subject of registration of vital statistics. Section IV discusses the errors and bias present in census and registration data.

Sections V, VI, and VII, which account for almost half the text, are concerned with an extensive treatment of census and registration statistics in the development of mortality tables from population statistics. Also, incorporated in Section V are several pages on population projections which, although not treating the subject fully, do give quite a number of valuable references. Very extensive discussions are presented of the various formulas for mortality rates and of graduation and curve fitting methods, although perhaps too detailed and complex for most students.

Section VIII deals with the construction of abridged life tables, which are commonly prepared by demographers but are not generally utilized in actuarial work. Nonetheless, the actuarial student should have at least as much knowledge about abridged life tables as may be obtained from this brief treatment. The same general comments also apply to the relatively short treatments in Sections IX to XIII and XV which deal respectively with the comparison of mortality in various populations, forecasting mortality rates, mortality by cause of death, occupational mortality, demographic rates other than mortality, and sickness data. In most of these sections very adequate references are given so that more complete study is possible. However, the section on sickness data, consisting of only three pages, is quite limited for such an important field.

Section XIV describes rather briefly, although relatively adequately, measurements of reproduction, combining both fertility and mortality. Although this subject does not enter into the usual work of the actuary, this reviewer believes that most actuaries will find it to be quite a fascinating topic.

The beginning student will find this book a helpful adjunct to his readings. It is, however, the opinion of this reviewer that for most students Sections V to VII are somewhat too extensive and complex for their basic purpose of obtaining a knowledge of the fundamentals of the construction of population life tables. Of course, for those students who develop an intensive interest in the subject, the very thorough treatment given, as well as the large body of references, will prove invaluable.

ROBERT J. MYERS

C. H. Richardson, *An Introduction to the Calculus of Finite Differences,* pp. vi, 142, D. Van Nostrand Co., Inc., New York, 1954.

As implied by the title, this purports to be an elementary text on finite differences. The author has in mind students of electrical engineering and physics as well as actuarial and statistical theory. As it is a small book, it inevitably covers only a limited part of the whole subject. The selection of topics to be covered seems to the reviewer very peculiar. There is no mention whatever of divided differences, of Sheppard's central difference notation, of Woolhouse's and Lubbock's summation formulas, or of smooth-junction interpolation. On the other hand, there is a 19-page chapter on Bernoulli and Euler polynomials, an 11-page chapter on beta and gamma functions, and a 4-page appendix on hyperbolic

functions. All this latter material, in the reviewer's opinion, is out of place in an elementary text on finite differences. The Bernoulli and Euler polynomials are of little interest in themselves, and are not used elsewhere in the book; the former might have been used in developing the remainder term for the Euler-Maclaurin sum formula, but remainder terms are not discussed. The chapter on beta and gamma functions duplicates material usually given in texts on advanced calculus, and does not mention or use any finite-difference concept; the only excuse for its inclusion would seem to be the fact brought out much later in the book that the psi function (the derivative of the logarithm of the gamma function) is the finite integral of the function $1/x$. In three pages the author could have developed the few properties of the gamma function needed for this application. The beta function is never used. The excuse for the appendix on hyperbolic functions seems to be that two of these functions are casually referred to in the chapter on Bernoulli and Euler polynomials.

The other four chapters deal with basic concepts, finite integration and applications, interpolation and approximate integration, and difference equations. A useful appendix on mathematical induction is also included.

In general, the reviewer finds the exposition clear and the use of mathematical concepts precise and correct. The book would unquestionably be superior to Freeman for use as a college text if it were not for the poor selection of topics covered. The best chapter, in the reviewer's opinion, is the one on difference equations. This material is well organized and clearly presented. This is perhaps the chapter of greatest interest to actuaries, since these techniques could be profitably utilized in actuarial work and are not so readily available in other sources.

The reviewer has some criticisms on specific points. On page 18 the symbolic identities $E \equiv e^D$ and $D \equiv \log(1 + \Delta)$ are given without any warning as to the limitations on their use. On page 19 the author speaks of the "Law of Separation of Symbols." On page 44 the assumption that the coefficient A_i is a function of i only and independent of n is not clearly stated. In fact, the development of the Bernoulli functions on pages 44 and 45 would have been much clearer if they had been defined by means of equations (1) and (5) (which the author states "completely define" them) and if equation (2) had been derived as a property. A similar remark applies to the development of the Bernoulli polynomials of the second kind on page 55. The remark on page 58 that "we have no technique for finding the limiting value of A_i as i becomes infinite" is misleading. While it is true that elementary methods will not suffice, it follows from equation (38), §143, of Steffensen's *Interpolation* that the limit is zero. On page 90 the author says he is going to talk about negative and zero values of n and then immediately without warning enters into a discussion which applies only to positive values. On page 99 his method of checking a solution of a difference equation (where he assumes the equality he wishes to prove and reduces it to the identity $0 = 0$) is inelegant and, strictly speaking, insufficient. On page 106, he uses the term "linearly independent" without defining it. On pages 114–117, where he states, in several instances, that a particular integral can also be found by undetermined

coefficients, he gives no inkling as to how he arrives at the functional form assumed for the particular integral in order to apply this process. On the credit side, the reviewer particularly likes the following statement concerning mathematical induction on page 131 (italics in original):

It should be emphasized it is *not a method of discovery* but rather a method of *verification* of theorems or formulas that are believed, but not definitely known, to be true.

T. N. E. GREVILLE

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—Accident and sickness insurance; 4—Social security; 5—Other topics.

References to allied subjects will be found in the following publications: *Mathematical Reviews*, published by the American Mathematical Society—Subjects: Theory of probability, mathematical statistics, mathematical economics, various other mathematical topics; *Monthly Labor Review*, published by Bureau of Labor Statistics—Subjects: Cost and standards of living, employment and employment services, fringe benefits, handicapped, industrial hygiene, industrial relations, labor organization and activities, manpower, older workers and the aged, personnel management, social security (general); *Population Index*, published by Office of Population Research, Princeton University, and Population Association of America—Subjects: Mortality, fertility, marriage, divorce, the family, various other demographic topics; *Social Security Bulletin*, published by Social Security Administration—Subjects: Retirement and old age, employment, maternal and child welfare, health and medical care, various other topics in social security; *Journal of the Institute of Actuaries*—The review section contains digests in English of articles appearing in foreign actuarial journals.

ACTUARIAL AND OTHER MATHEMATICS, STATISTICS, GRADUATION

R. D. Clarke, "The Concept of Probability," *Journal of the Institute of Actuaries*, vol. 80, part I, no. 354, p. 1, 1954.

The author believes that "a comprehensive definition covering both quantifiable and nonquantifiable probabilities is desirable, and that the concept of probability should be envisaged as embracing a central zone where precise quantification is practicable surrounded by ever-widening circles of increasing vagueness." As an example of a common use of both the frequency and the degree-of-belief approaches to probability, he states: "If a healthy man presents himself for life assurance, we look up his probability of dying in a table which has been constructed from observed frequency ratios. But if a proposer suffers from some physical impairment, we ask the Medical Officer for a personal opinion on the degree of extra risk involved."

R. S. Burington and D. C. May, Jr., *Handbook of Probability and Statistics with Tables*, pp. ix, 332, Handbook Publishers, Inc., Sandusky, Ohio, 1953.

The early chapters describe elementary probability theory, generating and characteristic functions, and the binomial, Poisson and normal distributions. Later chapters deal with probability distributions in two or more dimensions, regression theory, time series, sampling distributions, statistical inference, significance tests and confidence

intervals, and the analysis of variance. There is a short chapter on sequential analysis, sampling inspection, and quality control. This book is a convenient reference to the elements of statistical method and contains a number of tables handy for statistical computations.

H. Vaughan, "Symmetry in Central Polynomial Interpolation," *Journal of the Institute of Actuaries*, vol. 80, part 1, no. 354, p. 63, 1954.

In practice, all polynomial interpolation formulas which are applied centrally have the property of symmetry. It is here shown that "certain properties, usually attributed to particular formulae, are in fact general, and can be deduced directly from the principle of symmetry." The following paragraph is noteworthy: "Writers have distinguished between the 'classical' and more recent osculatory formulae on the ground that the fundamental principle of the former was that derivatives at the junction-points should have certain predetermined values, and that this restriction was later abandoned. This is a false distinction, since for every formula there is a definite value for such derivatives. The line of approach to a formula by the original research worker is of historic interest, but should not affect the classification of the formula at the present time."

H. B. Curry, "Abstract Differential Operators and Interpolation Formulas," *Portugaliae Mathematica*, vol. 10, no. 4, p. 135, 1951.

This paper develops, in terms of abstract operators, a very general interpolation formula, which includes as special cases not only all the classical finite-difference interpolation formulas (including Lagrange's formula and its more general form involving repeated arguments known as Hermite's interpolation formula) but also the Euler-Maclaurin expansion. Reprints are obtainable from the author at The Pennsylvania State University.

A. A. Henderson and R. Schlaifer, "Mathematical Programing—Better Information for Better Decision-Making," *Harvard Business Review*, vol. 32, p. 73, May–June 1954.

Management is frequently confronted with operational problems that involve a multiplicity of interrelated factors. In such situations, the solution, in terms of reduced cost or increased profit, is generally sought by trial and error, using skill and experience as a guide. In many instances, the problems may be channeled into a routine by mathematical, or linear, programing. With this procedure "there is a rule for finding a program to start with, there is a rule for finding the successive changes that will increase the profits or lower the costs, and there is a rule for following through all the repercussions of each change. . . . It is because the procedure follows definite rules that it can be taught to clerical personnel or handed over to automatic computers." This procedure leads to an optimum solution. The authors outline the principal limitations to this technique and also describe several applications of it. For one common type of problem the procedure is outlined in detail.

LIFE INSURANCE AND ANNUITIES

E. A. Lew, "Insurance Mortality Investigations of Physical Impairments," *American Journal of Public Health*, vol. 44, p. 641, May, 1954.

The author "(1) draws attention to the salient features of several types of life insurance mortality investigations in which various factors, including physical impairments, have been studied; (2) describes the essential procedures used in such long-range follow-up studies; (3) outlines the scope and the principal findings of the more important investigations of the mortality associated with physical impairments; and (4) discusses

both the limitations and the special value of the data for medical science and public health." Much of the material is conveniently summarized in tabular form.

E. A. Lew, "Some Implications of Recent Changes in Mortality," *Transactions of the Association of Life Insurance Medical Directors of America*, vol. 37, p. 4, 1954.

Although mortality in general is decreasing, cancer and the cardiovascular-renal diseases, and particularly coronary artery disease, are growing rapidly in importance among the causes of death. As a consequence of expressing underwriting limits as a percentage of the low present day mortality rates, the underwriter is called upon to make overly fine distinctions. It might be preferable to extend the limit of the standard mortality class to include 1 or 1.5 extra deaths per thousand at ages under 40, say. Savings in underwriting expenses and improved public relations would counterbalance increases in standard mortality. Greater emphasis in the medical examination on cardiovascular-renal diseases and the development of new practical diagnostic tests for the early detection of cancer and heart diseases would result in more scientific classifications of risks with fewer cases declined or offered substandard ratings.

P. G. Denker, "The Evaluation and Classification of Neuropsychiatric Disorders," *Transactions of the Association of Life Insurance Medical Directors of America*, vol. 37, p. 142, 1954.

The classification of persons suffering from psychiatric disorders presents difficulties to the layman and, while standard mortality may be expected with many forms of psychoneurosis, they constitute extremely poor disability risks. Several criteria are advanced to assist the underwriter in detecting such disorders. Among these are vague or frequent illness, absence from work for fatigue or exhaustion, frequent changes of employment, family history of mental illness, and maladjustment to marriage and social life.

W. H. Sheldon, *Atlas of Men: A Guide for Somatotyping the Adult Male at All Ages*, pp. xvi, 357, Harper & Bros., New York, 1954.

The present volume, the fourth of a series on human constitution, presents the progression of weight changes in tabular and graphic form for each of 88 somatotypes for the ages from 18 to 65 years, using as a basis the measurements of 46,000 American men. Photos are shown of 1,175 persons in three positions—front, side and back. Significant information is presented, as part of a continuing project, regarding certain diseases considered largely constitutional, such as diabetes, peptic ulcer, gall bladder disease, heart disease, rheumatoid arthritis, thyroid disorders, cancer and the cycloid and schizophrenic psychoses. A discussion of length of life appears in connection with many of the classes of somatotypes.

ACCIDENT AND SICKNESS INSURANCE

E. S. Williams, "One Year's Experience in Family History and Surgical Expense Insurance," *Transactions of the Association of Life Insurance Medical Directors of America*, vol. 37, p. 201, 1954.

The Life Insurance Company of Virginia began writing individual hospitalization and surgical insurance on a weekly premium basis in February 1951. This report summarizes their experience with these benefits from July 1, 1952 to June 30, 1953. Hospitalization claim rates and average surgical claim expenses, as well as the proportion of total claim payments arising from the more important diagnoses, are tabulated by age group for adult males, adult females and children. Claim problems which have proved to be troublesome are discussed.

J. C. Horan, "Morbidity Experience under Personal Accident and Health Insurance," *Transactions of the Association of Life Insurance Medical Directors of America,* vol. 37, p. 217, 1954.

The objectives in accident and health underwriting and life insurance underwriting are contrasted and discussed. Diseases which produced the longest periods of disability, and which are the ones most likely to pre-exist among applicants practicing antiselection, may be acceptable for life insurance with varying degrees of rating. The problem of pre-existing conditions is not solved with entire satisfaction by the use of exclusion riders. A study of the whole problem of morbidity is needed to enable companies to offer complete coverage with appropriate extra premiums.

O. N. Serbein, Jr., *Paying for Medical Care in the United States,* pp. xxiv, 543, Columbia University Press, New York, 1953.

Under a grant from the Health Information Foundation, a project was set up to study the methods used to pay for medical care in the United States. This project, carried on within Columbia University, did not gather any new data, but concerned itself with the collection of a large mass of available material which was analyzed and digested to provide the facts for this volume. The report includes information on the prevalence and cost of illness, the extent and character of medical resources, a description of protection afforded by insurance companies, Blue Cross, Blue Shield, and other plans, and the extent of the coverage provided. The part played by industry, government, and other groups is outlined. Arguments for the use of deductibles in insurance and for the financing of minor expenses of medical care through personal and family budgeting are advanced. The advent and development of major medical expense insurance and of extended benefits under Blue Cross programs are also described.

Department of National Health and Welfare, *Voluntary Medical Care Insurance: A Study of Non-Profit Plans in Canada,* pp. 222, Research Division of the Department of National Health and Welfare, Ottawa, 1954.

This study is concerned solely with medical care insurance (as distinct from hospital care insurance) offered through the so-called nonprofit agencies in Canada and does not therefore deal with "the experience of commercial insurance companies." It is published as Memorandum No. 4 in a General Series issued by the Department of National Health and Welfare and deals quite comprehensively with the historical development of the plans being studied, the nature and level of the benefits they offer, and their financial experience. Data are also given on the number of persons enrolled in the various plans and on the volume of medical care services being rendered to them.

SOCIAL SECURITY

R. J. Myers, "Mortality After Retirement," *Social Security Bulletin,* June 1954.

Relatively little is known about the effect of retirement on mortality, since it is difficult to isolate its effect from those of other factors. This article analyzes the available experience under OASI and other governmental systems, as well as certain experiences under group annuities and private pension plans previously presented to the Society. The conclusion is reached that there is no evidence that compulsory retirement has a serious effect on an individual's health although it is conceded that this is possible. Experience under plans with voluntary retirement provisions shows high mortality immediately after retirement, but this can probably be explained by the selection element (disabled persons and those in poor health are more apt to retire as soon as possible) in determining retirement. In plans that have disability benefits payable before normal retirement age, high mortality among age retirements is not as evident.

House of Representatives, "Analysis of the Social Security System," *Hearings Before a Sub-Committee of the Committee on Ways and Means,* 83rd Congress, 1st Session, 1953, pp. 1194.

These hearings were held by the so-called Curtis Committee during the latter half of 1953 as a factual study on various aspects of social security. The hearings themselves are published in 6 parts and in 2 appendixes. The hearings primarily involved witnesses from various branches of the Federal government and dealt with such subjects as population trends, tax treatment of individuals under private pension plans, OASI benefits paid abroad, relationships between veterans benefits and OASI benefits, economic status of the aged, the technical provisions and operations of OASI and public assistance, the actuarial and financial portion of the OASI program, and the legal status of OASI benefits. Appendix I presents 179 statistical tables, giving much detailed data on OASI and public assistance that is not available elsewhere. Appendix II is a collection of 20 miscellaneous documents concerned with the legal status of OASI benefits and public assistance payments as well as several very pertinent articles on the philosophical basis of the OASI program.

W. J. Cohen, R. M. Ball, and R. J. Myers, "Social Security Act Amendments of 1954: A Summary and Legislative History," *Social Security Bulletin,* September 1954.

During 1954, the Congress passed legislation that resulted in extensive changes in the Old-Age and Survivors Insurance system. This article, which summarizes the legislative history of the amendments, gives a detailed statement of the final legislation and a digest of the actuarial cost estimates. As is the case with all major legislation, the interested student may obtain a full legislative background from the published House and Senate hearings on the legislation and from the committee reports on the bill (House Report No. 1698 and Senate Report No. 1987, 83rd Congress, 2nd Session). In addition, somewhat more detailed actuarial cost estimates are published in a special committee print ("Actuarial Cost Estimates for the Old-Age and Survivors Insurance system as modified by the Social Security Amendments of 1954," August 20, 1954, prepared for the House Committee on Ways and Means by R. J. Myers).

Committee on Retirement Policy for Federal Personnel, "Report on Retirement Policy for Federal Personnel," Senate Document 89, 83rd Congress, 2nd Session, 1954, pp. 1199.

This report of the Committee on Retirement Policy for Federal Personnel (commonly called the Kaplan Committee) is in 5 parts.

Part 1 is an extensive summary and analysis of some 25 different programs providing retirement benefits for Federal civilian and military personnel. Included for comparative purposes are analyses of a number of plans in private industry and in state and local governments as well as certain studies of recent retirees.

Part 2 contains the Committee's proposal in regard to the retirement system for the uniformed services which, in brief, involves extending OASI coverage to this group and establishing a supplementary survivor benefit system. At the same time the free insurance under the servicemen's indemnity system and certain other overlapping programs such as Veterans Compensation would be eliminated.

Part 3 covers the Committee's recommendations as to the Civil Service Retirement program. In brief, OASI coverage would be extended and the existing system would be revised to provide supplementary retirement and, to some extent, survivor benefits for career employees.

Part 4 includes the actuarial report with analyses and recommendations on financing; thus, systems for civilian employees would be funded on a "normal plus interest" basis, while the military system would continue on a pay-as-you-go basis. There is also a summary and analyses of the actuarial valuation reports on various Federal systems (aggregate figures are 5.3 million persons covered, 540,000 on the benefit roll, $850 million annual disbursements, $5.7 billion funds on hand, and $30 billion unfunded liability of which the uniformed services system accounted for about 60%). In particular, a realistic interest rate assumption for all plans is suggested. The rate would probably be uniform, say 3%.

Part 5 contains the analyses and recommendations as to special and miscellaneous benefit provisions. These relate to such items as benefits for employees in hazardous service and to special retirement systems for certain groups of civilian employees.

House of Representatives, Hearings on "Health Inquiry" and "Health Reinsurance Legislation," Committee on Interstate and Foreign Commerce, 1953–54, pp. 3151 and 453, respectively.

H.R. 8356, known as the "Health Service Prepayment Plan Reinsurance Act," was designed to furnish reinsurance facilities (without Government subsidy as to reinsurance costs) for health service prepayment plans of private insurance carriers. In effect, losses in excess of premiums earned, less $\frac{5}{8}$ of administrative expense, would be reinsured 75% by the Government. Hearings were held on this bill, and it was reported out by the House Committee (*House Report* 2106). The Senate Committee on Interstate and Foreign Commerce also held hearings on the bill and reported it out (*Senate Report* 1798). The bill failed to pass in the House and was not acted on by the Senate, but studies are being continued as to the possibility of expanding voluntary insurance in this manner rather than initiating compulsory health insurance.

The House Committee had previously held extensive hearings in 1953 and early 1954, but this was a routine responsibility and did not result in a bill. The hearings, in 8 parts, include valuable information—the first 5 on the causes, control, and remedies of the principal diseases of mankind, and the last 3, perhaps of more interest to actuaries, on available health plans and group insurance programs.

OTHER TOPICS

Dominion Bureau of Statistics, *Canadian Life Table, 1951*, pp. 13, Health and Welfare Division of the Dominion Bureau of Statistics, Ottawa, 1953.

The table presented in this report (Reference Paper No. 50) gives elementary values from age zero to the end of the table for males and females separately. It is based on the deaths by sex and age recorded as having occurred during the three calendar years 1950–52 and on the population at the midpoint of the period, as obtained through the 1951 census. This table continues the series published by the Dominion Bureau of Statistics covering the years 1931, 1941, 1945 and 1947 as listed in previous issues of the *Transactions*.

R. H. Daw, "Some Statistical Aspects of Mortality from Degenerative Heart Disease," *Journal of the Institute of Actuaries*, vol. 80, part I, no. 354, p. 69, 1954.

On the basis of a detailed study of the trend of mortality from degenerative heart disease from 1931 to 1949 in the general population of England and Wales by age and sex, the author concludes that (i) the three broad categories (coronary disease, cardiovascular degenerative disease, other myocarditis) that constitute the degenerative heart diseases show differing features, (ii) some of the increase in mortality from coronary dis-

ease may be real, (iii) changes in food consumption during and after the war may account for a wartime trough in the heart disease rate, (iv) mortality from coronary disease graded down rapidly from social classes I to V in 1930–32, but the grade appears to be much less steep in 1949, very likely as a result of a leveling in the quality of diagnosis between the classes, and also possibly due to changes in food consumption, (v) mortality from heart disease is increased in severe winters, probably by hastening deaths of certain cases, rather than causing additional deaths.

E. C. Hammond and D. Horn, "The Relationship Between Human Smoking Habits and Death Rates," *Journal of the American Medical Association*, vol. 155, p. 1316, August 7, 1954 (reprinted with additions).

With the aid of 22,000 volunteer workers, the American Cancer Society conducted a follow-up survey of 187,766 white males aged 50–69 years who were traced from early 1952 to October 1953; these men were resident in the Middle Atlantic States, certain North Central States, and California. Men seriously ill were not included in the survey. There were, altogether, 4,854 deaths in this experience. Among the regular cigarette smokers there were 3,002 deaths, and the mortality rate was 52 per cent in excess of that for nonsmokers. Moreover, the excess mortality increased with the amount of cigarette smoking.

Almost half of the deaths in the experience were ascribed to diseases of the coronary arteries. The mortality pattern from these conditions with regard to extent of cigarette smoking followed that for all causes, except that the upward gradient was much steeper. Mortality from cancer was also higher among regular cigarette smokers than among nonsmokers. In the case of lung cancer, the death rates among men with a history of regular cigarette smoking were considerably greater than those for men who had never smoked regularly; among the group who smoked one or more packs of cigarettes a day at the time of questioning the excess mortality from this cause was still greater. Even those smoking less than one pack of cigarettes daily had significantly higher death rates from lung cancer than those who never smoked. There were no other specific causes of death for which data were sufficient to warrant further comparisons.

M. E. Davis, "The Use of Electronic Data Processing Systems in the Life Insurance Business," *Proceedings of the Eastern Joint Computer Conference*, Washington, D.C., December, 1953.

This paper reviews briefly the studies made by the Society of Actuaries' Committee on New Recording Means and Computing Devices and sets forth six basic principles which should guide the development of plans for using electronic data processing systems in life insurance operations. It then discusses the nature of office routines, the possibility of magnetic tape files and some of the limitations of currently available electronic equipment.

A portion of this paper which is of considerable interest deals with the reasoning which led one company to acquire magnetic tape computing equipment. The many considerations involved in reaching a decision are clearly set forth, including the question of whether to wait until possibly more efficient electronic equipment is available. The paper closes with emphasis on the necessity for potential users to make extensive investigations into the manner in which electronic machinery can be introduced into their operations gradually and with due regard for the human elements involved.