



SOCIETY OF ACTUARIES

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Book Review*(Continued from page 3)*

book and the thoughts they stir up. Imagine the consequences of this statement; "It is estimated that in the U.S.A. 1,500 transplant operations *a day* may eventually be called for." The author appears to justify a possible expenditure of hundreds of millions of dollars a year of public funds for few more years of life to those with severe kidney disease.

The question of restricting biological research and the need for legislation to do this is discussed. The fears raised are justified. However, he quotes the eminent English neurologist, the late Lord Brain: "To argue that knowledge can be a bad thing is a waste of time, since the impulse to know is an inherent part of human nature."

At least one development mentioned should be dealt with by legislation — the "deep freeze" for human corpses. In the U.S. a number of people have paid sums to ensure that, at death, their bodies will be preserved by freezing in the belief that in due course techniques will be discovered whereby they can be revived and the disease which caused their death be overcome. It is true that if a person died of pneumonia in 1920, say, and had been preserved until today, he could, almost certainly, have been cured. But consider having several generations of one's family in a "freezatorium" with the cost of the expert attention which the bodies would require and the responsibility of deciding when to revive them.

Any means of deferring "final" death, presents particular problems when the brain is concerned for the brain cells have not the faculty of renewing themselves. Thus the prospect arises of a population of physically fit people with senile minds. Then Regius Professor of Medicine at Oxford is quoted: "I find this a terrifying prospect and I am glad I shall be dead and will have ceased to make my own contributions to this catastrophe before it happens."

A final set of quotations is from the chapter headed "New Minds for Old": "The last twenty years have seen the emergence of three important groups of drugs acting on the mind . . . We may actually be on the way to banishing insanity . . . The way things are going, it looks as if soon we shall be able not only to drive men mad with drugs, but also to drive them sane." □

COMMENTS ON MORTALITY STUDIES*by A. C. Webster*

In the 1968 Reports of the Committee on Mortality Under Ordinary Insurances and Annuities, there are two special studies in addition to the regular Annual Report on Mortality under Standard Ordinary Issues for the 1966-67 year of exposure. These special studies cover the experience on Term Conversions and Guaranteed Insurability Options between the 1961 and 1966 policy anniversaries. One study treats of mortality and the other of lapses. All business is standard and for all the studies expected deaths are based on the 1955-60 Basic Tables.

Vietnam war deaths, as might be expected, are of greater weight in the 1966-67 study than previously and the major effect is on non-medical issues. The inclusion of war deaths in the select non-medical experience (over \$9,000,000 of the total deaths of \$86,000,000) raised the actual to expected ratio from 107% to practically 120%. On medically examined business the effect of war deaths was minimal for the total experience.

At the young entry ages (roughly 5-34) where the effect of war deaths was at a maximum, the increases in the ratio due to Vietnam war deaths were as follows:

Non-medical from 107% to 124%

Medical from 97% to 100%

Non-medical business is still about the same proportion of the total select exposure—36%. In the aggregate, the non-medical mortality is still higher, 107%, compared with 93.2% for the medical business but if the mortality is compared at the more important non-medical ages (say under issue age 35) the difference between medical and non-medical does not seem to be of major consequence.

Female mortality continues favorable, being still around 60% of the male (56% for medically examined business and 62% for non-medical business).

Options and Conversions

This was the first attempt to get mortality experience for elections under the Guaranteed Insurability Option rider and the results are not meaningful because of a paucity of data. One interesting figure—based on 37 deaths—is the mortality ratio in the first year after election—335%.

If there is to be anti-selection on term conversions this should show up in the mortality figures for the years immediately succeeding conversion. Here are the figures by age groups for the first three years immediately succeeding conversion by number of policies (the results by amount are not significantly different) with expected deaths reflecting select mortality from date of conversion:

Age at Conversion	25-34	35-44	45-54	55-64	65 & over
Duration from Conversion					
1	174%	185%	220%	285%	292%
2	146	191	196	221	268
3	144	148	161	209	316

Mortality ratios vary by type of term insurance. Decreasing term seems to show the highest ratios. The above are figures for all types of term conversion.

These figures which refer to duration from date of conversion may be questioned as being the true measure of anti-selection. For this reason mortality by duration from original issue was also studied. Theoretically the results might be expected to show a mortality ratio increasing with duration from original issue with emphasis on the later durations. The experience figures do not bear this out although there is considerable variation among the age groups, and at ages 55 and over the experience was very favorable at all durations.

The Committee was able to get additional data from the contributing companies on the comparative mortality of term insurance and permanent insurance and on the proportion of business sold on convertible term coverage. The report remarks that ". . . at least among those companies contributing to this portion of the study, there is relatively little difference between term and permanent mortality, although there is considerable variation among companies." This is an interesting result be-

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BOOK REVIEW

The Mathematical Sciences, A Collection of Essays, Edited by the National Research Council's Committee on Support of Research in the Mathematical Sciences, pp. 271, The M.I.T. Press, 1969, \$8.50.

by E. H. Wells

This collection of 22 essays written for persons of mathematical interests covers developments in a variety of mathematical fields, in relation to their applications to the sciences.

The essays are not written in "popular" style, but they require a minimum of advanced mathematics, well within the range of a mathematics major. Each essay starts at the foundations of its subject, and carries the reader through intermediate historical steps to modern research developments. Frequently unsolved problems and the most probable conjectures are cited. Each author is a recognized expert in the specialty under consideration.

As a sampling of the essays the following four may be of most general interest to actuaries:

1. Probability—Mark Kac (Rockefeller Univ.)

Starting with the intuitive approach of Laplace, the author traces the origin of the normal curve, which reappears often as an empirical law describing variability of population parameters. The author progresses to the relationship of probability to Brownian motion, Bertrand's paradox, Buffon's needle problem, and a number of other classical items. It is, however, only in this century that probability theory has become respectable, through a proper rigorous treatment, vindicating Laplace's insight when he wrote: "The most important questions of life, for the most part, are really only problems of probability."

2. Numerical Analysis—Philip J. Davis (Brown Univ.)

Commencing with the early determination of Archimedes that π has a value between 3-10/71 and 3-10/70, the author progresses through the pre-electronic techniques of Whitta-

ker and Robinson, and others, using differential and difference equations, matrices, approximation of roots, interpolation, and infinite series methods. From this background, he describes the vast growth of techniques resulting from analog computers and electronic digital computers in very recent times. The name "Numerical Analysis" is itself new, dating from about 1950.

3. Statistical Inference—Jack Kiefer (Cornell Univ.)

Inverting probability, statistical inference starts with the observed result and guesses the model. Various interesting simple examples are given, showing that the guesses are not unique. Modern developments of the subject started from Karl Pearson, at the turn of the century, through the work of R. A. Fisher and Neyman to Wald's approach (1939).

4. Prospects of Computer Science—Jack Schwartz (NYU)

The author describes many remarkable improvements in computer hardware, reducing costs, and increasing speeds. These developments have been paralleled by software break-throughs, involving source languages. There is a discussion of the computer as an artificial intelligence. The present state of comparison is represented as: brain is to computer as diamond mining is to coal mining; but additional computer progress is foreseen.

Any reader getting through these four essays, or others that he might prefer, would find it difficult to lay the book down. Could he resist temptation he would suffer the misfortune of missing reading about the Continuum hypothesis; Complex analysis in relation to elementary particles; the role of mathematics in economics, the social sciences, and the physical sciences; three essays on various facets of topology; vector spaces; and the applications of set theory and group theory—to mention a few of the remaining essays. □

Mortality Studies

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cause of the general impression that term insurance will give a poorer mortality. On the other hand, the practice of the individual companies may impose a stricter selection upon term insurance. The figures are given by individual companies and make interesting reading as do the tables showing variations in Mortality Ratios by Companies.

Lapse Study

For the first time a Lapse Study was made as a by-product of the mortality investigation. This probably explains why we have Lapse Rates by Amount which have never seemed to this reviewer to be of much value. It is to be hoped, however, that future studies will continue to provide Lapse Rates. There seems to be a definite shortage of information here.

The first year Lapse Rates were highest for conversions from Term Plans providing automatic conversion. This result might have been expected. For conversions from other forms of Term insurance, the first year Lapse Rates which were low, were in many instances about 50% higher than the second year rate. A relatively constant Lapse Rate might have been expected from this group. The Duration 1 Lapse Rates showed a wide variation by company ranging from 3.1% to 11.6%.

These results and the mortality results show how important it is for each company to keep tabs on its own experience.

Further Studies

There are two special studies in process: 1) mortality under individual immediate annuities and 2) mortality under policies for large amounts. The results are scheduled for publication in the 1969 Reports Number.

The Committee is preparing a pamphlet entitled "Statistical Records of Individual Policies for Mortality Studies" to serve as a guide for preparing and maintaining records for future studies. The methods suggested in this pamphlet will be of help to companies of all sizes who wish to investigate their own experience. □

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