PERMANENT TOTAL DISABILITY FROM ACCIDENTAL CAUSES

BY

W. N. WILSON

A disabled life table, to be proper and suitable as a basis of evaluating permanent disability claims arising out of accidental causes, should be constructed out of data similar in nature and accumulated under conditions closely paralleling those which gave rise to the disabilities it purports to measure. It is unfortunate that, so far as the writer has been able to ascertain, no American permanent total disability table based entirely upon lives disabled by accidents has been produced. It was because of a realization of this growing need that the experience herewith presented was compiled; and it is being submitted to this Society with the hope that it may stimulate sufficient interest in the subject to prompt others with similar experience available to prepare it, so that ultimately a dependable basis may be afforded for an American experience table based solely upon lives disabled by accidents.

The data consists mainly of mortality rates for the first five years after inception of disability as experienced upon workmen's compensation permanent total disability cases of the Travelers Insurance Company; a distribution of these same cases by nature of disability; and, for comparative purposes, a similar distribution of disease permanent totals as experienced on Travelers life contracts.

REVIEW OF EXISTING LITERATURE

By far the best papers so far published upon the subject of permanent total disability will be found in the Transactions of the Actuarial Society of America.* Many of the members present are thoroughly familiar with these papers, but some who have been following other fields of actuarial work might appreciate a brief

*A great deal of literature on this subject has also been published in other countries, but as Mr. Dawson in his discussion of Mr. Little's paper states, "The most valuable literature is in the T. A. S. A." Other sources, however, are: "The Swiss Experience," published by Haer Schaertling; "The German Government's Table on Death Rates Among Workingmen," Mr. Louis Weber; "Bulletin of the French Institute of Actuaries"; and the French table "1904–Tariff."

review of what has heretofore been published pertaining to the subject of this paper. In giving such a review the opportunity will also be taken to emphasize any references which have been made in the past to the accident phase of the subject. At first thought it is surprising how few these have been, but it does not seem so remarkable when it is remembered that disability coverage as offered in connection with life insurance involves no factor which would tend to cause a predominance of either sickness or accident claims.

Excellent articles on permanent total disability have been written by Messrs. Jackson, Meade, Pipe, Bohlman, Little and Hunter, and with several of these are presented large volumes of American fraternal experience. (T. A. S. A.) The discussions, likewise published in the Transactions, will also be found valuable and interesting. It should be mentioned, however, that each of these articles is largely devoted to the development of formulae for calculating disability premiums and the treatment involves primarily the rate at which lives become disabled, whereas this paper deals with a further stage, the course of life after the commencement of disability.

One of the most valuable contributions is that of Mr. Arthur Hunter, which appeared in volume twelve. Using as the basis of his article the experience of three American fraternals, Mr. Hunter has given a very clear mathematical treatment of premium calculations for disability benefits on life contracts, including a few remarks as to the value, from a life insurance standpoint, of tables prepared from fraternal records. He would anticipate a considerable difference in the experience, due partly to the possible inaccuracy of the statistics and partly to the difference in exposure produced by medical selection in life insurance.*

Mr. Hunter is among the few writers who have included a treatment of disabled lives during the period of disability. He has given mortality rates by ages for each of the first ten years as well as aggregate rates covering in all 3,027 disabled lives. An interesting statement is also included to the effect that the death rate upon disabled lives may, with the gradual increase in the period of

*The difference here referred to would show up in the rate at which healthy lives become disabled. There is a further difference to be expected in the experience of fraternals and insurance companies, and that is to be found in the mortality rate after disability, the difference being due to the varying degrees of disability considered as permanent and total.

disability, be expected to approach that of the general population as a limit, as one may expect that the lives remaining after a few years will be composed largely of the blind, victims of double amputations, and other invalids whose disabilities will not be serious obstacles to longevity.

Mr. Little is another writer who, in addition to a discussion of disability premiums, has devoted a portion of his article to the mortality of disabled lives. (Vol. XIV, T. A S. A.) He even goes a step further than some by intimating that the lives disabled by disease will probably die off more quickly than those disabled by accident, the point being raised in connection with the possibility of selection against a life insurance company where an option is granted of choosing paid up insurance or an annuity. That particular problem, however, has since then become less important as the provisions of the disability clauses in life insurance have changed. Nevertheless, the mention by Mr. Little and the consequent discussion of the point by Mr. Jackson show that even back in 1913 the American actuaries were thinking seriously of the possible difference in mortality on accident and disease victims.

Mr. Meade, in T. A. S. A., Volume XII, presents another very interesting article on permanent total disability. He does not distinguish between accident and disease victims. He does, however, strongly emphasize the point that the possibility of an invalid surviving a number of years is increased up to a certain point with the lapse of time after the beginning of disability.

This last point is very important and will bear considerable thought. One often hears a remark to the effect that some certain injured person, having been totally disabled for a number of years, probably cannot have much longer to live. In the case of a man disabled only a year the remark might be that in all probability he will not die for several years. This type of reasoning is based too much on the thought that disabled lives may be expected to live on the average a certain number of years. The whole subject takes on a different aspect when we consider Mr. Meade's quotation of Mr. Louis Weber—a French authority—"that whether the invalidity result from disease or accident, it is always a sign of the weakening of the organism, and that morbid state, present or past, constitutes a second factor, at least as important as age, which influences the degree of vitality. Invalidity is, therefore, at each instant, subject to two causes of death—weakness due to increas-

ing age and weakness due to infirmity." Further on Mr. Weber continues—"an invalid of forty who was stricken with incapacity for work twenty years before is unquestionably much more robust than another invalid of the same age who has been the victim of an accident at the age of thirty-nine, for the very fact of having survived twenty years after a shock so violent as to cause permanent disability is certainly a guarantee of future survival which is not afforded to the recent invalid."

If Mr. Weber's thoughts are accepted as reasonable, the obvious practical conclusion is that the reserves for pensions to totally disabled lives should increase for some time after the beginning of disability even though payments have been made meanwhile.

The experience presented by Mr. Meade is also taken from American fraternals and covers 5,144 disabled lives, of whom 2,361 had died at the end of the period of observation. Mr. Meade, like Mr. Hunter, gives the mortality rates by age and year of disability.

Mr. Craig in his discussion of Mr. Hunter's paper brings out another point which deserves attention in studying mortality rates on disabled lives. Admitting that the mortality rates do decrease for a time at least after inception of disability, then it must be conceded that there is bound to be a difference in the aggregate mortality rates produced by any two different sets of experience, depending upon the distribution of the exposure as between fresh lives and those disabled for some time. In considering this point it is interesting to note that the German government statistics show the mortality rate at age 35 to be .22 for the third year after disability; .14 for the fifth year, and .11 at seven years after the commencement of disability.

It is further contended by some writers that an ultimate table on disabled lives would show a mortality closely approximating that of the general population. There is room for difference of opinion on this point, however, as the past morbid state referred to by Mr. Weber must always have some influence on vitality. If it were possible to determine the exact relation of the two laws involved, an ultimate table might be developed, but this is a refinement hardly to be hoped for. The obstacles encountered in producing even an aggregate table have led many of the life actuaries to the conclusion that the only practical basis of valuing annuities to invalids is by means of a select table, and when a select table is available, based upon sufficient and reliable exposure,

it will undoubtedly replace any existing tables used for valuation purposes.

Mr. Flynn, in his discussion of Mr. Meade's paper, also speaks of the decreasing mortality rate just mentioned, pointing out that "the use of an aggregate annuity table on disabled lives will give results which will be seriously underestimating the liability in valuing annuities on lives disabled a few years."

In discussing the possible difference in the experience on disease as against accident cases, Mr. Flynn again states that, "a table prepared from general permanent total disability statistics may not be adequate when applied to cases of permanent total disability as encountered in workmen's compensation insurance," presumably because the latter are primarily due to accident. To support his contention he compares the annuity values of Mr. Meade, based upon disease and accident cases combined, with the annuity values used in France in valuing claims under employers' liability experience, which latter table he believed to have been based upon lives disabled by accident only. His comparison follows:

Age	Meade	English Employers' Liability	French Employers' Liability (1904—Tariff)
25	15.803	16.235	20.758
35	13.935	14.403	18.715
45	11.236	12.372	15.932
55	9.089	10.004	12.637
65	7.473	7.250	9.079

A still more remarkable comparison is that of the annuity values as of date of inception of disability.

Age	Meade	French (1904—Tariff)
20	6.3891	16.9403
30	7.9994	15.9610
40	7.3793	13.8719
50	6.7371	11.1670
60	6.3193	8.3216
70	6.0358	5.4558

If the differences noted in the above figures can be attributed to the type of disability, accident or disease, as Mr. Flynn suggests, then there can be little doubt but that the distinction is an important one.

Following the presentation of this comparison, Mr. Dawson, in an oral discussion, stated that in Norway "an analysis of available experience has led the actuaries to adopt the practice of assuming accident permanent total annuities the same as those for the general population." This practice is no doubt an extreme one, especially if applied when the period of disability has been less than two years. It does, however, show very clearly how far in this direction Norwegian actuarial opinion has crystalized.

Opportune Year for Consideration of Subject

This is an exceptionally opportune year for a consideration of this subject, as the growth of the non-cancellable form of accident and health contract has interested many persons in life pension contracts who have not hitherto dealt extensively with them. Mr. Cammack has offered a reserve table for annuities on this line, and his table is being generally accepted. There is the possibility, however, that its use on non-cancellable claims may lead to the practice of applying it to "regular accident" claims. Consequently, it is necessary to bear in mind that, whereas the table is applicable to a line such as non-cancellable accident and health insurance, where claims may be expected to occur from disease and from accident in natural proportion, it is not advanced as a proper reserve table for claims arising solely from accidents, as is the case in "regular accident" insurance.

Value of Workmen's Compensation Disability Experience

By far the largest volume of experience in this country on accident permanent total cases is that of the companies issuing workmen's compensation insurance, but this is not truly representative of all accident total disability as only "at occupation" accidents are included. This objection is not serious, however, as it is the resulting disability and not the cause of accident which influences the mortality rate and the only possibility of a different mortality rate on "at occupation" and "foreign to occupation" disability cases is the possibility that the two "distributions by nature of disability" differ. One thing is certain, that a table based on this experience would be the best possible for valuing

workmen's compensation permanent total pensions. It may further be contended that an error is involved in using workmen's compensation experience unless that of all companies covering all States and all industries can be obtained, as the resulting values will be unduly influenced by the experience of particular sections and particular industries. However, it is too much to hope that all experience can be obtained and it is, therefore, advisable to study the data that is available. If several of the larger companies would compile their experiences, these, when combined, even though not the entire experience of the country, should furnish valuable indications, if not a dependable basis for mortality rates.

It should be mentioned here that although various State insurance departments have required the reporting of all permanent total experience, and one at least has published the mortality experience on a part of the cases reported, it is not safe to use these data in the preparation of a mortality table, as a number of inaccuracies enter into these figures which it is impossible for the departments to correct. An example of such is found in the inclusion of permanent partial cases which have been granted permanent total awards.* The companies could easily exclude such cases by an examination of their claim files.

One bad feature of the workmen's compensation experience is that the claims have not developed beyond a few years, and consequently the mortality rates can be studied for only a short period. For the same reason, the total number of deaths experienced so far would necessarily be small, whatever the volume of experience obtained. It is not essential, however, especially considering the preparation of a select table, that the number of deaths be large, if the exposure for the first five years is sufficient. All that is necessary is a comparison of rates for the first few years with those of existing tables. The data furnished herewith shows very few deaths, but the indications of even this small volume should not

*The late Dr. Downey has published certain data compiled from the experience reported to the Pennsylvania Insurance Department. The objections to accepting the mortality rates shown by that experience are: The possible inclusion of permanent partial cases; the undue influence of particular industries when only one State's experience is included; and the possible inaccuracies in age due to the fact that no pensions are provided in that State and consequently the age is not deemed so important in reporting. In considering the nature of disability distribution, it can be readily believed that this feature is not followed up as closely by the department as would be possible from an examination of company claim files.

be ignored if we consider the exposure, remembering at the same time that Mr. Meade's entire experience covered only a little over 5,000 lives and Mr. Hunter's considerably less than that. Again, probably neither experience included as many accident permanent totals as does the experience here given.

Preparation of Data Herewith Presented

In preparing the data from which the mortality rates were drawn, it was first necessary to examine each of the claim files to determine whether the nature of disability was really permanent and total, or whether the case was a permanent partial that had been granted permanent total compensation. Thirty-five of this latter type were found and accordingly excluded from the experience. It will also be noted that only the mortality on lives disabled prior to age 60 is shown in the first exhibit. The experience was divided at this point for two reasons; first, because various forms of insurance are now issued where only disability occurring prior to age 60 is covered, and secondly, because a large number of the permanent total cases over age 60 are caused only partly by the accident and partly by the age of the injured. It is not unusual for a doctor to pronounce an old man unable to return to work, when in reality he has fully recovered. The explanation is that the man would be able to work only a few years longer in any event before he would be disabled by old age, and both the doctor and he believe the pension to be of greater value than any possible future wages. Of course, great care is taken on the part of all insurance companies to guard against such claims, but it is impossible to prevent a few of them. In the experience used there were over 90 lives included where disability occurred after age 60, and in all probability a considerable number of these were recoveries not reported.

PERMANENT TOTAL DISABILITY MORTALITY EXPERIENCE

(Travelers Workmen's Compensation Experience)

AGE	SECOND YEAR			THIRD YEAR		
	Exposure	Actual Deaths	Hunter's Expected	Exposure	Actual Deaths	Hunter's Expected
16–20	5.00	0	1.9	3.91	0	.8
21–25	12.17	0	3.8	7.16	1	1.2
26–30	21.83	1	5.8	16.25	1	1.3
31–35	30.50	3	7.6	25.41	1	3.0
36–40	22.58	0	5.0	11.83	0	1.3
41–45	30.33	0	6.7	25.58	1	3.0
46–50	18.41	2	3.9	18.41	2	2.7
51–55	22.08	3	4.5	19.16	0	2.5
56–59	23.16	0	4.5	10.66	0	1.4
	186.06	9	43.7	138.37	6	17.2

	FOURTH YEAR			MORE THAN FOUR YEARS		
16–20	1.00	0	.1	.00	0	.1
21–25	4.00	0	.4	1.50	0	.1
26–30	12.11	0	1.1	6.58	0	.4
31–35	18.25	0	1.5	19.41	2	1.1
36–40	9.91	0	.7	4.00	1	.2
41–45	17.33	0	1.4	23.33	1	1.3
46–50	13.91	0	1.3	18.16	1	1.2
51–55	15.83	0	1.6	12.16	0	.9
56–59	6.58	0	.7	8.16	0	.7
	98.92	0	8.8	93.30	5	6.0
Total all years	516.65	20	75.7			

COMPARISON OF ACTUAL AND EXPECTED MORTALITY

There were over 330 cases in the experience before the two limitations of age and permanent partial disability were applied, or in all about one-tenth the exposure used by Mr. Hunter. A comparison with the latter's table shows that even though the Travelers' data is meagre, it is, nevertheless, consistent throughout in its indications of low mortality. Mr. Hunter's table was used for comparison not only because it is the generally accepted standard in this country, but also because it shows lower rates than either Mr. Meade's or Mr. Pipe's, and is 9 per cent. lower in the aggregate than the German government tables.

The totals of the figures show 20 actual deaths as against 76 expected. The actual number of compensation deaths might have

increased considerably before the mortality would have become even one-half that of Mr. Hunter's. Judging from these figures, it would appear safe to assume that the mortality from the second to the fifth year of disability is not more than half the expected, according to Hunter's table.

There was some question as to just what rates of mortality to use as Mr. Hunter's in order that the figures might be directly comparable.* The rates used in preparing the following comparison are the lowest which it was believed might reasonably be taken for this purpose. The experience on lives over age 60 is also given as well as a comparison of actual and expected deaths using the American Experience mortality rates.

TOTAL DISABILITY MORTALITY EXPERIENCE

(Travelers Workmen's Compensation Experience)

SECOND AND SUCCEEDING YEARS COMBINED				
Age	Exposure	Actual Deaths	Expected Hunter	Expected (Amer. Exper.)
16–20	9.91	0	2.28	.08
21–25	24.83	1	4.24	.20
26–30	56.77	2	6.97	.47
31–35	93.57	6	8.62	.82
36–40	48.32	1	4.20	.45
41–45	96.57	2	8.31	1.02
46–50	68.89	5	6.12	.86
51–55	69.23	3	6.62	1.13
56–59	67.88	1	7.23	1.56
60 and over (taken as 63)	121.77	7	13.77	4.13
	657.74	28	68.36	10.72

ACCIDENT VS. DISEASE MORTALITY

From the last tabulation it is seen that the death rate on accident permanent totals, although much lower than the expected according to disability tables, is still considerably above that of the American experience. The conclusion to be drawn, if any were possible, would be that the accident permanent total mortality rate is not more than half that of disease permanent totals, and, taking Hunter's as the best example of the latter, this would reduce

*Mr. Hunter has assumed the application for disability to be made on the anniversary date of the policy. An interpolation of the values given by him is therefore necessary before a comparison can be made with the data given in this paper.

to the more specific statement that accident permanent total mortality rates for the first five years of disability may be taken as one-half the rates shown in Hunter's analyzed table. (That Hunter's table is not high for disease cases has been shown by the results of two or three investigations of life insurance companies.)

One of the life actuaries has suggested that although the mortality for the first few years may be heavier on disease permanent totals than upon accident, nevertheless, after the lapse of several years, this may not be true, and may even be the opposite, owing to the fact that a large percentage of the then remaining disease permanent totals will be blind and insane persons, upon whom the mortality will be not far from that of the general population. This last if true would undoubtedly be perplexing; but perhaps the answer is, at least it so appears from the distributions in this paper, that the percentage of blind invalids is not large, and the mortality of insane persons is actually a great deal heavier than that of the general population. Some interesting data tending to support this last conclusion have been added as an appendix to this paper.

Mortality Curve for First Year of Disability

Another interesting tabulation taken from available workmen's compensation experience is the distribution of deaths throughout the first year of disability. Four hundred and fifty-one deaths from accident, occurring from two days to one year after the date of accident, were investigated.

It was assumed that all of these cases were of permanent total disability, as each was disabled from the accident till the time of death. Mortality rates were calculated for several different periods throughout the year. The results are interesting, as they show the remarkable drop in the mortality rate with the lapse of time after accident. As the exposure was the same as that used in the investigation of the mortality after one year, these long term cases have been included in the number exposed. Mortality rates for all ages combined are shown for each period. Mr. Hunter's analyzed table shows the decrease in the rates with each succeeding year. This tabulation with the accompanying graph offers a

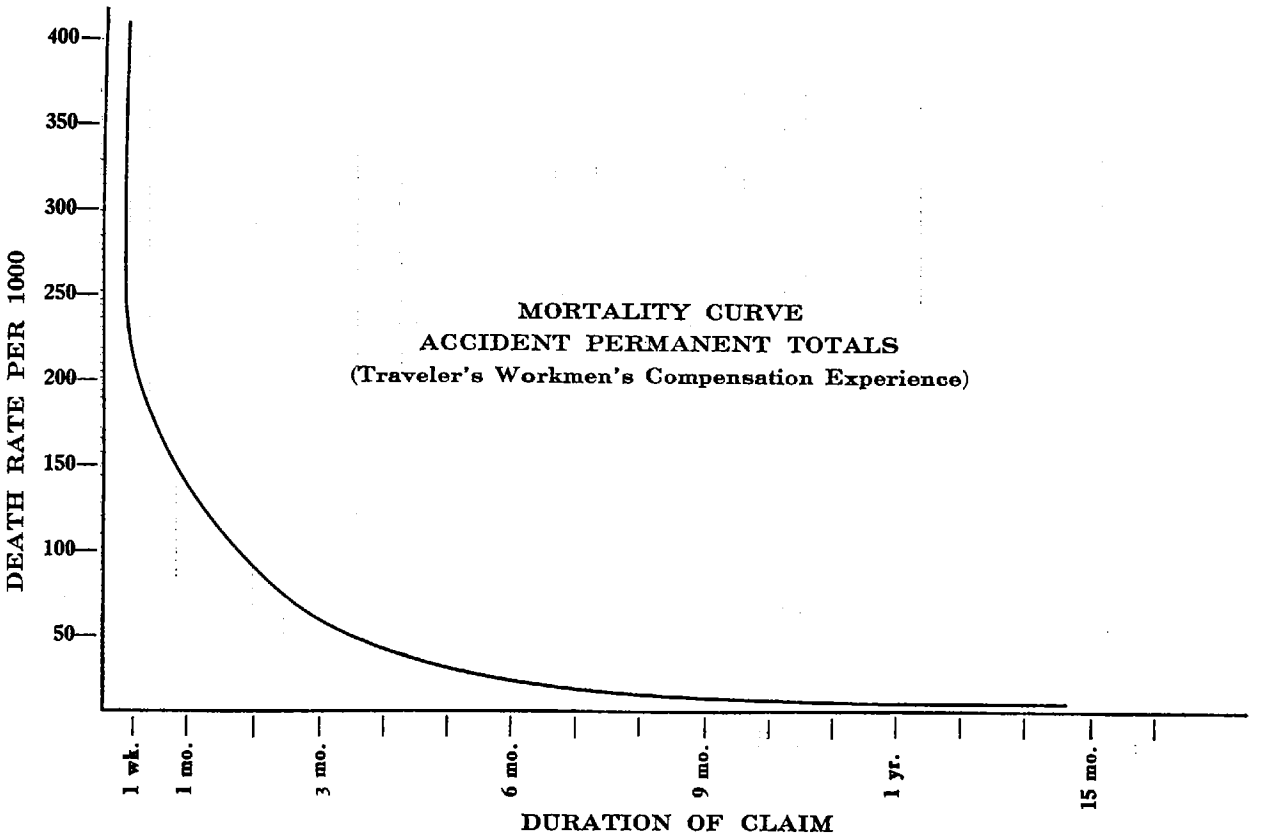
picture of the way the mortality curve runs during the first year. It should be noted that the periods used in the tabulation are of increasing length.

DISTRIBUTION OF DEATHS BY PERIODS

LIVES DISABLED BY ACCIDENT

(Travelers Workmen's Compensation Experience)

DURATION	No. DEATHS	EXPOSED	MORTALITY RATE
2–7 Days	157	637	.246
8–15 Days	97	480	.202
16–30 Days	64	383	.167
2nd Month	48	319	.150
2nd Two Months	35	271	.129
3rd Two Months	30	236	.127
3rd Three Months	15	206	.073
4th Three Months	5	191	.026
2nd Year	9	186	.048
3rd Year	6	138	.043
4th Year	0	9	.000
More than 4 Years	5	93	.054


MORTALITY CURVE
ACCIDENT PERMANENT TOTALS
(Traveler's Workmen's Compensation Experience)
DEATH RATE PER 1000
400
350
300
250
200
150
100
50
1 wk.
1 mo.
3 mo.
6 mo.
9 mo.
1 yr.
15 mo.
DURATION OF CLAIM

Distribution of Disease Permanent Totals by Type of Disability

In support of the statement that Mr. Hunter's table is probably based primarily on disease cases, it might be mentioned that in an investigation of 333 permanent total disability claims approved by the Travelers' life department, only nine were the result of accident. Likewise, Mr. Craig's distribution, Mr. Henderson's, and others that have been published, invariably show a small percentage of the disability cases arising from accidents. As there is no appreciable factor connected with any of these experiences which would tend to cause an unduly large number of either type of claim, it may be assumed that Mr. Hunter's experience is largely composed of disease victims.

The distribution of the Travelers claims is here given:

CAUSES OF TOTAL PERMANENT DISABILITY
(Claims Approved by the Travelers' Life Department)

	Individuals	Policies
General Diseases		
Tuberculosis of Lungs	106	123
Other Varieties of Tuberculosis	5	5
Cancer and Other Malignant Tumors	18	24
Other General Diseases	14	15
	143	167
Diseases of the Nervous System		
Locomotor Ataxia	10	10
Other Diseases of the Spinal Cord	17	20
Cerebral Hemorrhage and Apoplexy	17	27
Paralysis without Specified Cause	5	6
General Paralysis of the Insane	38	43
Other Forms of Mental Alienation	47	61
Epilepsy and Non-Puerperal Convulsions	3	3
Other Diseases of the Nervous System	9	11
Blindness	8	8
	154	189
Diseases of the Circulatory System		
Organic Diseases of the Heart	7	8
Diseases of the Arteries	4	5
	11	13
Diseases of the Respiratory System	3	4
Diseases of the Digestive System	1	2
Diseases of the Genito-Urinary System		
Bright's Disease	3	6
Diseases of the Bones	3	4
Affections Produced by External Causes		
Traumatism	6	11
Fractures, Cause not Specified	2	6
Other External Violence	1	1
	9	18
Cause of Disability Not Specified	6	6
Total (February 1, 1922)	333	409

Mortality Rate Varies with Type of Disability

It might also be well to mention at this point that the mortality rate may be expected to vary according to the nature of disability. This is brought out strongly in the next three distributions prepared from practically the same workmen's compensation experience as was used for the previous tabulations. It will be seen that some causes of disability, such as "Burns," have practically no long term cases, while others show a large percentage in the distribution for over one year. Thus, it can readily be seen that having produced a table of mortality rates on disabled lives, its applicability to any other permanent total disability experience will depend largely upon the degree to which the original nature of disability distribution is reproduced in the particular experience to be considered. It is possible that, in the distant future, experience will be available in sufficient volume to permit the tabulation of exposures and deaths for each of the more frequent forms of invalidity and the preparation of separate reserve tables for each. Such refinement, however, is rather visionary, and for a long time to come a single standard accident permanent total mortality table is all that can be hoped for, and, in fact, is all that would now be practical.*

*A comparable problem exists in life insurance. It is generally admitted that the mortality rates differ for various sections of the country, but the practice prevails of using one mortality table for the entire United States. Clerical expense, travel privileges, lack of experience, and many other considerations make the use of more than one table impractical.

DISTRIBUTION BY NATURE OF DISABILITY OF LIVES TOTALLY DISABLED BY ACCIDENT

Surviving *Less than Three Months* after Accident

TRAVELERS WORKMEN'S COMPENSATION EXPERIENCE

Nature of Disability	Age at Accident			
	Under 60	60 and Over	Unknown	All Ages
Loss of, or Loss of Use of Both Feet	1	..	..	1
Paralysis of Legs	1	2	..	3
Other Paralysis	1	1	..	2
Hernia	8	1	..	9
Back or Spine Injury	34	3	2	39
Tuberculosis	1	..	..	1
Hip Injury	15	6	3	24
Fractured Skull	51	16	6	73
Nervous Shock	2	..	..	2
Abdominal Injury	7	4	1	12
Neck Injury (Broken, etc.)	...	1	..	1
Septicaemia	31	18	6	55
Tetanus	2	2	3	7
Gangrene	2	2	2	6
Burns	38	2	8	48
Gassed	1	..	1	2
Trauma to Body	16	5	..	21
Meningitis	3	1	1	5
Hemorrhage	5	4	..	9
Pneumonia	11	..	..	11
Peritonitis	4	..	..	4
Internal N. O. C.	30	5	13	48
Other N. O. C.	25	8	7	40
	289	81	53	423

DISTRIBUTION BY NATURE OF DISABILITY OF LIVES TOTALLY DISABLED BY ACCIDENT

Surviving *More Than Three Months and Less Than One Year* After Accident

TRAVELERS WORKMEN'S COMPENSATION EXPERIENCE

Nature of Disability	Age at Accident			
	Under 60	60 and Over	Unknown	Total
Loss of, or Loss of Use of Both Feet	1	..	..	1
Paralysis of Leg	1	..	..	1
Hernia	1	1	..	2
Back of Spine Injury	8	2	..	10
Tuberculosis	2	..	..	2
Hip Injury	5	1	2	8
Fractured Skull	5	1	..	6
Nervous Shock	1	..	..	1
Abdominal Injury	2	..	..	2
Septicaemia	4	2	2	8
Gangrene	1	..	1	2
Internal N. O. C.	7	2	2	11
N. O. C.	8	2	2	12
	46	11	9	66

DISTRIBUTION BY NATURE OF DISABILITY OF LIVES TOTALLY DISABLED BY ACCIDENT*
Surviving *One Year* After Accident
TRAVELERS WORKMEN'S COMPENSATION EXPERIENCE

Nature of Disability	Age at Accident			
	Under 60	60 and Over	Unknown	Total
Loss of, or Loss of Use of Both Eyes	31	2	3	36
" " " " " Feet	27	14	2	43
" " " " " Hands	17	9	0	26
" " " " One Hand and One Foot	4	2	0	6
Mentally Affected	11	3	0	14
Paralysis of Legs	12	1	1	14
Other Paralysis	12	4	0	16
Hernia	2	3	0	5
Back or Spine Injury	37	14	4	55
Tuberculosis	4	0	0	4
Hip Injury	10	14	3	27
Fractured Skull	15	6	3	24
Nervous Shock	4	1	1	6
Head Injury—Dizziness	6	1	0	7
Abdominal Injury	1	3	0	4
Heart Affected	2	1	0	3
Neck Injury (Broken, etc.)	4	0	1	5
Trauma to Body	3	0	1	4
Other N. O. C.	24	12	0	36
	226	90	19	335

*All cases of permanent partial disability, even though awarded permanent total compensation, were excluded from this experience.

MEDICAL OPINION ON ACCIDENT VS. DISEASE MORTALITY

An interesting experiment was here tried relative to the difference in mortality on accident and disease invalids. It was believed that if there really was such a difference as the foregoing limited experience seemed to indicate, a study of the two distributions by nature of disability should reveal the reason. Accordingly, the disease and the "over one year" accident distributions were submitted to three different doctors and each was asked to indicate after each nature of disability the average number of years which he believed persons so disabled might be expected to live, assuming all had been disabled just one year. Weighing these estimated durations by the number of cases, it was found that all three doctors had estimated that the accident victims would live approximately twice as long on the average as the diseased men. The

fact that three prominent doctors concurred in their opinions on this point should not be taken too lightly. In fact, it should be a rather conclusive argument that the true value of the accident mortality rates may be expected to lie somewhere between the disease rates and those for the general population. The result also tends both to substantiate the statements which a number of actuaries have made from pure judgment without actual distributions, and to indicate that the results produced by the experience here presented are probably not far different in the aggregate than would be produced by a more extensive investigation.

Permanent Partials Included as Permanent Totals

A review of the permanent partial claims which had been compensated as permanent totals disclosed the fact that 17 had been granted awards under the claims of loss of both hands, 13 under loss of both feet, and one each under paralysis, hip injury, and loss of one hand and one foot.

Accident and Health Experience

Another but smaller volume of experience which might possibly be compiled is that of the regular accident insurance companies, but, judging from the results of an investigation made of the experience of the Travelers, it seems doubtful whether the entire volume of regular accident experience in this country would be sufficient to give any indications of value.

Concluding Remark

Although the statistics here presented do not represent a very great exposure, still, as previously stated, if a number of persons who may have workmen's compensation experience available will contribute it, sufficient data may be gathered to make possible the preparation of a dependable table of mortality rates on lives permanently and totally disabled by accident.

APPENDIX
ON THE MORTALITY OF INSANE LIVES

1. *Australian Experience.*

An examination of the table below will show that in Australia the mortality of insane persons is higher than for healthy lives. The figures and the quotation are taken from the report of the Actuary of the Australian Mutual Provident Society, as printed in the *Economic World,* Nov. 19, 1921, in an article on "Insanity in an Applicant's Family History from the Life Insurance Standpoint."

"Bulletin No. 10 of Social Statistics recently published by the *Commonwealth Statistician* gives some interesting data regarding insane patients during the year 1918. From the information therein given I have calculated the ratios of death to population for the various groups of ages and have compared the results with the corresponding ratios for the general population, and find them to be as follows:

INSANE PATIENTS		AUSTRALIAN MALE POPULATION	
Ages	Deaths to Population	Ages	Deaths to Population
		2	.00677
Under 5	.01772	3	.00441
5–10	.09666	7	.00209
10–15	.02604	8	.00196
15–20	.08102	12	.00184
20–30	.05190	13	.00199
30–40	.04135	17	.00304
40–50	.05037	18	.00332
50–60	.05592	25	.00449
60–70	.08352	35	.00636
70–80	.17997	45	.01089
80–90	.27746	55	.01832
90	.26667	65	.03934
		75	.10097
		85	.21911
		92	.37990

"I think we may conclude from this: (1) That excepting at extreme old ages the mortality of insane persons is very much heavier than that of the general population. (2) That even the care received in modern hospitals cannot overcome this excessive

mortality. (3) That any tendency to insanity revealed by family or personal history, or by examination, should be regarded as a serious impairment."

2. *Experience of New York State Institutions.*

The thirty-first Annual Report of the New York State Hospital Commission shows that the four outstanding causes of mental diseases except those of heredity are syphilis, contributing 14.2 per cent., senility 10.8 per cent., arterio sclerosis 12.3 per cent. and alcohol 6.4 per cent. Certainly none of these types of insane persons can be expected to show longevity. The average death rate for ages taken from the records of all State institutions is .098, and the average age of the patients is about 40, the sex being about 52 per cent. female and 48 per cent. male. The average death rate is thus considerably higher for New York State insane institutions than the general population death rate for the average age given.

The doctor at the Manhattan State Hospital, from whom this data was obtained, advised that, "Any judgment of these figures should be tempered by the fact that in institutions managed by the State there are segregated a great many of the debilitated old as well as alcoholics, syphilitics, arterio-sclerotics and seniles."

3. *United States Census Statistics.*

The United States Census Report 1910 gives a tabulation of the mortality rates upon insane lives. The average mortality rate is given as .1008 which is somewhat higher than the figure for New York State institutions.

4. *Remarks.*

It is generally true of insanity that the more violent forms are accompanied by very heavy mortality and lighter forms by light mortality. Most of the mentally unbalanced included in the accident distribution of permanent totals are of a mild form and therefore, according to the theory just stated, may be expected to show lighter mortality than the average. This conclusion has been drawn after an individual consideration of each of the cases of mental affliction included as permanent totals in the distribution of the preceding paper.

U. S. CENSUS REPORT—1910
Mortality of Insane

Age	Exposure	Rate
Under 15	668	.1290
15—19	4,851	.0930
20—24	13,502	.0758
25—29	21,110	.0653
30—34	26,386	.0705
35—39	30,351	.0732
40—44	29,790	.0756
45—49	28,555	.0750
50—54	25,762	.0884
55—59	19,751	.0907
60—64	15,601	.1269
65 & over	28,042	.2439
Unknown Age	4,191	.1150
Total	248,560	