

**ACCIDENTAL DEATH EXPERIENCE:
A REVIEW OF RECENT EXPERIENCE FOR THE PRACTICING
ACTUARY AND THE 1996 ACCIDENTAL DEATH BENEFITS
MORTALITY TABLE**

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ABSTRACT

Over the past 40 years, three analyses of ordinary life accidental death mortality experience have been conducted by the Society of Actuaries. The last version of an accidental death valuation mortality table was produced in 1959. This paper considers recent accidental death mortality experience applicable to both ordinary life policies and other accident products, presents a possible new valuation accidental death benefits mortality table for U.S. business, and provides several sources for actuaries interested in more information about accidental death mortality.

Rather than basing the possible new valuation accidental death benefits mortality table on a detailed review of recent insurance company experience, the analysis of experience was made by using data from a variety of other sources. The data used were collected from publicly available materials. This approach was selected to demonstrate the feasibility of using noncompany experience for developing current expected accidental death experience.

I. INTRODUCTION

A valuation table for accidental death insurance was last developed by the Society of Actuaries four decades ago. It was based on data using ordinary life insurance experience from 1951 to 1956. The table provides only unisex mortality rates.

Accidental death mortality patterns have changed over the past four decades. There is a need for an accidental death valuation mortality table that not only reflects current levels of accidental death mortality but also is applicable for accidental death benefits included in accident and health (A&H), special risk, blanket, group, or other policies.

The 1959 Accidental Death Benefits (ADB) Table [2] was constructed from the accidental death mortality experience of riders attached to ordinary life policies. About 90% of this experience was from male insureds. Currently the percentages of males and females who are covered by individual life insurance are nearly identical [1]. Therefore, it is desirable to have separate accidental death valuation mortality tables by sex.

Individually sold accidental death insurance is provided under a variety of insurance contracts. Both individual and group policy forms are used. Accidental death products are offered as riders to individual life insurance policies, included as extra benefits in group life insurance policies, written on both life and A&H forms, issued in "special risk" situations (including blanket insurance programs), and in other forms. Some accidental death contracts cover all types of accidental deaths, while others provide benefits for only a portion of accidental deaths (for example, travel-related accidental deaths).

Accidental death insurance covers deaths resulting from falls, drownings, motor vehicle accidents, and other accidents, but such contracts also pay benefits when an insured's death results from homicide and the specific cause is otherwise not excluded by the contract. For certain population segments in the U.S., homicides are both a leading cause of violent deaths and a major cause of death from any cause.

Most accidental death coverages, other than those which are part of individual life insurance contracts, are marketed without individual underwriting or on a guaranteed issue basis. It is common to underwrite groups for accidental death insurance so that premiums recognize any special exposures (for example, industrial classifications, avocational risks, and so on).

Accidental death coverage is a line of business that requires substantial numbers of insured lives before there is a sufficient number of claims to assign a high level of credibility. Moreover, because of concentrations of risk (such as a family traveling in a car or a factory with many workers), some accidents result in multiple deaths. For example, for 1994 the National Safety Council (NSC) reported about 38,000 motor vehicle accidents involving fatalities and 43,000 motor-vehicle-related deaths, or slightly more than 1.1 deaths per motor vehicle accident [9, p. 82].

Many insurance companies reinsure some or all accidental death exposures and/or purchase catastrophic loss reinsurance covering multiple deaths (typically three to five or more deaths from a common accident) as a way of mitigating fluctuations in accidental death experience.

Overall accidental death experience has improved since the development of the 1959 ADB Mortality Table. Section III demonstrates the dramatic reduction in accidental death mortality experience over the past four decades as well as describes some of the reasons for the improvement in experience. On the other hand, the homicide death rate has increased during the same period.

The range of accidental death products and the methods used to market accidental products have also changed over the past 40 years. In the early

1950s accidental death insurance provided by life insurance companies would have been mainly as riders to ordinary life policies or rather small benefits in accident and health policies. In contrast, for the past several years very large quantities of accidental death coverage are provided by special policies sold through banks, associations, employers, credit cards, and other groups.

As a result of the improvements in accidental death rates, the shift in types of persons being covered for accidental death risks, and the range of accidental death products, a new valuation mortality table is needed. The development of a proposed new accidental death valuation mortality table begins with a review of the development of the 1959 ADB Mortality Table, as described in Section III.

Section IV reviews recent accidental death experience. The proposed 1996 Accidental Death Benefits Mortality Table is presented in Section V.

The paper concludes with two sections: Section VI is designed to assist the practicing actuary in applying the proposed accidental death valuation table, and Section VII is designed to heighten an actuary's awareness to the changing nature of accidental death experience.

The information in this paper is intended to guide and assist an actuary in developing accidental death premiums and reserves. Because accidental death insurance is an entire spectrum of coverages, an actuary pricing or reserving accidental death coverages must carefully analyze a particular product or situation before utilizing this information. For actuaries interested in learning more about accidental death experience, a listing of sources of information (including how to contact these sources) is provided in the Appendix.

II. ACCIDENTAL DEATH EXPERIENCE 1953-94

From 1953 (the midpoint of the period from which data were collected for the 1959 ADB Mortality Table prepared by the Society of Actuaries [10]) to the 1990s, the rates and patterns of accidental deaths (including homicides) have changed significantly. Basic population accidental death rates have dropped by more than 40% from 60.1 deaths per 100,000 in 1953 (and also approximately the average for the period 1951-55) to 35.1 per 100,000 in 1994 (and also approximately the average for the period 1992-96) [9, p. 36]. In the other direction, however, is the alarming trend in the homicide death rate, which doubled over the same 40-year period [11, pp. 11, 12]. Overall, accidental death and homicide rates have dropped by more than 30% since the early 1950s.

While accidental deaths and death rates (other than homicides) have trended downward during the past four decades, over relatively short spans of years the numbers and rates of accidental deaths are more or less constant. For the past 15 years the number of accidental deaths in the U.S. has averaged in the lower 90,000s. There are now about 25,000 homicides per year in the U.S. [9, pp.17, 37].

The Society of Actuaries has conducted two studies of U.S. accidental death mortality experience for accidental death benefits from ordinary life insurance policies since the creation of the 1959 ADB Mortality Table:

- Accidental death experience between 1970 and 1975 policy anniversaries [3]
- Mortality by cause of death between 1983 and 1988 policy anniversaries [5].

Table 1 presents a summary of the observed accidental death mortality rates (which would include homicides) from the 1950s, 1970s, and 1980s SOA studies.

TABLE 1
INDIVIDUAL LIFE INSURANCE ACCIDENTAL DEATH RATES
PER 1,000 FROM SOA STUDIES

Age Group	Male			Female		
	1950s*	1970s†	1980s**	1950s*	1970s†	1980s**
20-24	0.664	0.704	‡	0.124	0.176	‡
25-29	0.359	0.415	0.363	0.098	0.107	0.108
30-34	0.305	0.352	0.363	0.088	0.123	0.108
35-39	0.296	0.322	0.363	0.101	0.109	0.108
40-44	0.298	0.353	0.260	0.134	0.140	0.118
45-49	0.362	0.349	0.260	0.182	0.168	0.118
50-54	0.383	0.350	0.302	0.202	0.168	0.145
55-59	0.408	0.374	0.302	0.252	0.219	0.145
60-64	0.455	0.471	0.407	0.369	0.265	0.180
65-69	0.735	0.581	0.407	0.354	‡	0.180
70-74	1.015	0.776	0.751	0.898	‡	0.509
75-79	1.751	‡	0.751	‡	‡	0.509

* Table 15 (p. 69) of Ref. 10.

† Table 15 (p. 79) of Ref. 3.

** Table 4, years 16 and later, of Ref. 5. The data were reported in broad age bands.

‡ Where no data are shown, there were either no reported data or the data were not credible.

As shown in the table, the significant improvement in accidental death rates from ordinary life policies (for ages 20 and over) began in the 1980s and in the age groups 40 and over. However, below age 40 accidental death rates have increased rather than decreased. The general reduction in ordinary

life accidental death mortality for ages 40 and over parallels the general population accidental death experience [9, p.41].

The dramatic reduction in the general U.S. population accidental death rates (not including homicides) by age group between 1953 and 1996 is shown in Table 2.

TABLE 2
1953 AND 1996 U.S. POPULATION ACCIDENTAL DEATH RATES
PER 100,000* (EXCLUDES HOMICIDES)

Age Group	Death Rates per 100,000		Percentage Reduction 1953-94
	1953	1996	
Under 5	49.5	15.0	69.7%
5-14	22.1	9.4	57.5
15-24	61.4	37.8	38.4
25-44	46.4	32.7	29.5
45-64	60.5	30.2	50.1
65-74	106.7	43.9	58.9
75-over	383.6	140.9	63.3
All ages	60.1	35.2	41.4%

* pp. 40-41 of Ref. 9.

Clearly, the largest reductions in U.S. population (non-homicide) accidental deaths over the past more than 40 years have occurred in the very youngest and very oldest age groups. But even among teens and young adults, there has been a reduction in the accidental death mortality rate of more than 30%.

In terms of causes of accidental deaths including homicides, the data in Table 3 show the changes in the general U.S. population between 1953 and 1994.

The most noticeable change is in the rate of work-related accidental deaths, which has declined by 80% in the last four decades. However, about half of this reduction appears to be the result of a change in definition for work-related fatalities that began in 1992. (Beginning in 1992 the accidental death statistics reported by the NSC follow the Census of Fatal Occupational Injuries plan of the Bureau of Labor Statistics. However, the NSC's numbers are for unintentional deaths only.)

While automobile accidental deaths have remained the primary cause of accidental deaths in the U.S. during the last half of the 20th century, major improvements in automobile safety (for example, seat belts and air bags, better highway construction, and so on) have reduced accidental death rates resulting from motor vehicle accidents. Improved workplace safety

TABLE 3
U.S. POPULATION ACCIDENTAL DEATH RATES PER 100,000
BY CAUSE FOR 1953 AND 1994

Cause	1953	1994	Percentage Change 1953-94
Accidental deaths*	24.0	16.3	32.1%
Motor vehicle	9.5	2.1	77.9
Work related	18.3	10.1	44.8
Home	10.4	7.6	26.9
Public nonmotor vehicle			
Subtotal accidental deaths†	60.1	35.1	41.6%
Homicides**	4.8	9.6	-100.0%
Grand Total	64.9	44.7	31.1%

* pp. 36-7 of Ref. 9.

† The "subtotal accidental death" rate is not the total of the other lines because the subtotal eliminates the duplicate classification of accidental deaths between the motor vehicle, work, and home classifications.

** Homicide rates for 1994 from p. 10 of Ref. 9. Homicide rates for the 1953 homicide rate have been estimated from Ref. 13.

standards, increased general public awareness of the causes of accidents, and numerous other factors have contributed to the 41% reduction in the U.S. population accidental death rates (excluding homicides) over the past 40 years.

Unlike accidental death rates, homicide rates have increased over the past four decades. Much of the increase is concentrated in the younger adult ages. In general, age-adjusted homicide rates peaked during the 1970s, reaching 16.9 and 4.2 per 100,000 for males and females, respectively, and have declined since then but remain higher than the rates experienced in earlier decades [11, pp. 16, 17].

In the early 1950s the percentage of the U.S. population accidental deaths by sex was 69% male and 31% female [7]. The recent percentage of accidental deaths by sex is approximately two-thirds for males and one-third for females [9, p. 10] or essentially about the same for the last four decades.

In summary, the significant reduction in both ordinary life insured accidental death rates and general population accidental death rates makes a new valuation accidental death mortality table both desirable and justifiable.

III. THE 1959 ADB TABLE

Before a new accidental death benefits valuation mortality table is created, it is helpful to understand how the 1959 ADB Table was developed. The 1959 ADB Table was derived from a Society of Actuaries study of accidental deaths by using experience from individual life insurance contracts during 1951-56 that contained unrated accidental death exposures. The basic mortality rates were then loaded to produce the 1959 ADB Table, which has been used by actuaries as a valuation table and has been incorporated in state valuation laws, rules, and regulations.

Table 4 presents a summary of accidental death rates (including homicides) at quinquennial ages starting at age 2 from the 1959 ADB Table, the underlying mortality experience table from the 1959 ADB Table, and both the percentage loading and loading per 1,000 between the experience and final tables.

TABLE 4
1959 ACCIDENTAL DEATH BENEFITS TABLE SUMMARY*

Attained Age	1,000 \mathcal{Q} .		Loading	
	1959 ADB	Basic	Percentage	Per 1,000
2	0.451	0.347	0.300	0.104
7	0.307	0.207	0.483	0.100
12	0.330	0.230	0.435	0.100
17	0.723	0.556	0.300	0.167
22	0.675	0.519	0.301	0.156
27	0.424	0.324	0.309	0.100
32	0.387	0.287	0.348	0.100
37	0.389	0.289	0.346	0.100
42	0.405	0.305	0.328	0.100
47	0.450	0.346	0.301	0.104
52	0.477	0.367	0.300	0.110
57	0.552	0.425	0.299	0.127
62	0.686	0.528	0.299	0.158
67	0.900	0.692	0.301	0.208
72	1.238	0.952	0.300	0.286
77	2.214	1.703	0.300	0.511
82	4.168	3.206	0.300	0.962
87	6.367	5.367	0.186	1.000
92	9.298	8.298	0.121	1.000
97	13.164	12.164	0.082	1.000

* p. 754 of Ref. 2.

The general mortality pattern of the 1959 ADB Table is consistent with accidental death experience over the past several decades. Accidental death rates spike for teenagers and in early-20s age brackets. From the late-20s to

the late-50s accidental death rates are fairly level. Accidental death rates begin to increase at a fairly rapid pace at ages 55-60.

The sex distribution in the data used to create the 1959 Accidental Death Benefits Table was about 90% male and 10% female for the working adult ages (20-64). The working adult age groups represented about 90% of the data used to construct the table. Table 5 indicates that the basic accidental death mortality rates underlying the 1959 ADB Table for the working adult ages are generally between 35% and 45% of population accidental death mortality rates (including homicides) based on 90% male exposures.

TABLE 5
BASIC ACCIDENTAL DEATH MORTALITY RATES
UNDERLYING THE 1959 ADB TABLE

Attained Age	1953 Population Accidental Death Rates/1,000*				1951-56 Basic Accidental Death Rates/1,000	
	Male	Female	Total	90% Male	1,000 Q.	As Percentage of 90% Male 1953 Population
2	0.578	0.438	0.509		0.347	
7	0.275	0.146	0.212		0.207	
12	0.351	0.122	0.238		0.230	
17	0.927	0.240	0.588		0.556	
22	1.153	0.229	0.694	1.061	0.519	48.9%
27	0.992	0.192	0.585	0.912	0.324	35.5
32	0.883	0.197	0.534	0.814	0.287	35.2
37	0.849	0.206	0.521	0.785	0.289	36.8
42	0.890	0.214	0.547	0.823	0.305	37.1
47	0.920	0.243	0.580	0.853	0.346	40.6
52	1.007	0.265	0.633	0.933	0.367	39.3
57	1.022	0.299	0.656	0.950	0.425	44.7
62	1.181	0.394	0.782	1.103	0.528	49.9
67	1.396	0.576	0.974		0.692	
72	1.696	1.016	1.334		0.952	
77	2.655	2.042	2.323		1.703	
82	4.144	4.231	4.192		3.206	
87	7.252	8.914	8.226		5.367	
92						
97						

* Population ADB rates developed from Ref. 13.

The finding that insured accidental death mortality rates were much lower than the population accidental death mortality rates is not unexpected, because the basic data were from standard underwritten risks only and excluded nonstandard exposures. (Table 15 of the report from the Committee on Disability and Double Indemnity [10] presented the experience data and compared insured and population accidental death experience. The ratios in

this table are comparable to what has been described, but the basis of the comparison was U.S. White Population mortality experience rather than total U.S. Population experience).

In the current environment the major deficiencies of the 1959 ADB Table are the absence of sex-distinct mortality rates (historically females have much lower accidental death rates at nearly all ages than males) and the lack of an accidental death benefits mortality table that reflects current accidental death mortality experience levels.

IV. RECENT ACCIDENTAL DEATH EXPERIENCE

In the absence of a formal insurance industry study of accidental death benefits mortality for the 1990s, population accidental death mortality rates are a good starting point for a review of current accidental death experience.

A number of different sources of population accidental death mortality experience are available. The source that seems to be the most accessible and contains the most relevant data for actuaries is the NSC. On a regular basis this organization compiles a wide variety of U.S. and international accident statistics (see the Appendix).

The NSC provided a special table showing the number of 1993 accidental deaths (the most recent year available and also representative of recent accidental death mortality) by sex and five-year age brackets. The accidental death rates were derived by dividing the number of 1993 deaths by the U.S. population in the age category at July 1, 1993 using U.S. Department of Commerce data. The sex-distinct accidental death mortality rates for 1993 using this data are presented in column 1 of Table 6.

The NSC data excluded homicides. As mentioned earlier, accidental death insurance contracts usually cover deaths resulting from homicide. At some ages homicide rates in the U.S. are very significant. Particularly for young males, homicides dramatically increase the mortality rate for accidental death policies. Table 6 column 2 shows the 1991 population homicide and legal intervention rates. Column 4 of Table 6 presents these rates as a percentage of 1993 accidental death rates. The homicide rates were taken from *Vital Statistics of the United States 1991* [14, p.36] (because it is the most recent edition available and provides data by age and sex). The data for 1991 are sufficiently representative of homicide and legal intervention rates over recent years to be appropriate for development of the total picture of accidental death mortality. Quinquennial homicide age group data were not available for ages 85 and over.

Accidental death policies pay benefits in event of most homicides. Therefore, population accidental death rates consistent with insurance contract

TABLE 6
 RECENT POPULATION ACCIDENTAL DEATH^{*} AND HOMICIDE †
 MORTALITY RATES PER 1,000

Attained Age	(1) Accidental Death	(2) Homicide	(3) Combined Accidental Death & Homicide	(4) Percentage Homicide to Accidental Death Rates
Males				
1-4	0.200	0.030	0.230	15.0%
5-9	0.100	0.008	0.108	8.0
10-14	0.130	0.029	0.159	22.3
15-19	0.520	0.328	0.848	63.1
20-24	0.600	0.411	1.011	68.5
25-29	0.490	0.324	0.814	66.1
30-34	0.520	0.257	0.777	49.4
35-39	0.520	0.207	0.727	39.8
40-44	0.490	0.158	0.648	32.2
45-49	0.440	0.142	0.582	32.3
50-54	0.430	0.112	0.542	26.0
55-59	0.420	0.094	0.514	22.4
60-64	0.440	0.080	0.520	18.2
65-69	0.500	0.064	0.564	12.8
70-74	0.700	0.059	0.759	8.4
75-79	1.060	0.056	1.116	5.3
80-84	1.870	0.057	1.927	3.0
85-89	3.160		3.160	
90-94	4.830		4.830	
95-99	6.540		6.540	
100 and over	16.778		16.778	
Females				
1-4	0.148	0.026	0.174	17.6%
5-9	0.068	0.008	0.076	11.8
10-14	0.067	0.013	0.080	19.4
15-19	0.212	0.055	0.267	25.9
20-24	0.168	0.082	0.250	48.8
25-29	0.145	0.077	0.222	53.1
30-34	0.149	0.073	0.222	49.0
35-39	0.153	0.056	0.209	36.6
40-44	0.147	0.044	0.191	29.9
45-49	0.151	0.042	0.193	27.8
50-54	0.148	0.032	0.180	21.6
55-59	0.165	0.026	0.191	15.8
60-64	0.204	0.026	0.230	12.7
65-69	0.271	0.026	0.297	9.6
70-74	0.360	0.022	0.382	6.1
75-79	0.615	0.034	0.649	5.5
80-84	1.041	0.034	1.075	3.3
85-89	1.796		1.796	
90-94	2.896		2.896	
95-99	4.077		4.077	
100 and over	5.000		5.000	

* Accidental death rates for 1993 derived from a letter to Jay M. Jaffe from Alan F. Hoskin, Manager, Statistics Department, National Safety Council, July 11, 1996.

† Homicide death rates from pp. 36-37 of Ref. 12; the homicide death rates include deaths from legal intervention; rates for ages 85+ could not be separated into age groupings.

definition would be the combined accidental death rates for other than homicides plus homicide rates. These rates are shown in column 3 of Table 6.

Clearly, population accidental death mortality is not an appropriate standard for a valuation mortality table for individual life accidental death business. Section V explains the development of a valuation standard using the data just presented.

V. THE 1996 ACCIDENTAL DEATH BENEFITS MORTALITY TABLE

In the past, valuation mortality tables were developed based on a detailed study of insurance company experience (which became the "basic table") followed by the addition of margins for conservatism (resulting in the final valuation table). Not only is this approach very time-consuming and expensive, but also it is becoming more and more difficult to secure insurance company participation and funding for the development of experience mortality tables.

The data in Table 7 present a reasonable starting point for developing a new valuation accidental death benefits mortality to be called the 1996 ADB Mortality Table. As previously mentioned, a new valuation mortality table is needed because the 1959 ADB Table does not reflect current accidental death experience and it does not provide flexibility to meet the variety of accidental death and related products currently being sold by insurance companies.

TABLE 7
RATIO OF 1980 SOA ACCIDENTAL DEATH RATES* TO
U.S. POPULATION ACCIDENTAL DEATH RATES†

Attained Age	1980 SOA ADB Study		1986 U.S. Population		1980 SOA ADB as Percentage of U.S. Population ADB	
	Male	Female	Male	Female	Male	Female
	1,000 \bar{Q}	1,000 \bar{Q}	1,000 \bar{Q}	1,000 \bar{Q}		
25-29	0.363	0.108	0.953	0.242	38.1%	44.6%
30-34	0.363	0.108	0.817	0.209	44.4	51.7
35-39	0.363	0.108	0.701	0.189	51.8	57.1
40-44	0.260	0.118	0.629	0.189	41.3	62.4
45-49	0.260	0.118	0.606	0.180	42.9	65.6
50-54	0.302	0.145	0.608	0.192	49.7	75.5
55-59	0.302	0.145	0.590	0.202	51.2	71.8
60-64	0.407	0.180	0.607	0.251	67.1	71.7
65-69	0.407	0.180	0.637	0.312	63.9	57.7
70-74	0.751	0.509	0.855	0.459	87.8	110.9
75-79	0.751	0.509	1.267	0.678	59.3	75.1

* From Ref. 5.

† From Ref. 13.

The recommended variables for the 1996 ADB Table are attained age, sex, and risk category.

The 1996 ADB Table has been developed by using published current accidental death experience from non-insurance industry sources and has been constructed to represent standard underwritten accidental death benefit coverage such as would occur in ADB riders attached to ordinary life policies. This is consistent with the basis for the 1959 ADB Table.

However, because of the wide variety of risks that are insured for accidental death benefits and the wide range of experience from different blocks of accidental death blocks of business, it is recommended that a valuation actuary adjust the base table to reflect the expected experience for the actual accidental death product being valued. As used, "product" means not only the precise benefits being provided but also the underwriting, risk selection criteria, occupational or avocational exposures, or other conditions that affect accidental death rates. All these factors should be considered in determining the product's "risk category."

A few examples of "risk category" factors that can have a significant impact on the level of accidental death mortality are:

- Accidental death experience by geographic area ranges from less than 0.3 deaths per 1,000 in several states to 0.7 deaths per 1,000 in Alaska.
- Persons employed in high risk occupations are 1.50, 2.00, or more times as likely to die from an accidental death than those employed in average risk occupations.
- The probability of dying as a result of homicide varies dramatically among various population segments.

There is ample precedent for the variation in statutory mortality tables by class of business. The 1980 CSO Mortality Table has both smoker/non-smoker and ultimate/select versions so that reserves for a block of business can be matched with the expected mortality for that business.

The age group 20-64 would be the population most likely to be covered by individually underwritten accidental death insurance. In this age group the risks selected as standard would experience much lower accidental death mortality than the general population, because a significant percentage of occupational, avocational, and motor vehicle deaths would be eliminated by underwriting.

As noted in Section III and as shown in Table 5, the 1956 Basic ADB Table exhibited accidental deaths that were 35% to 45% of population experience and the insured group was about 90% male lives. Table 7 presents a comparison of the accidental death rates from ordinary policies from the

SOA 1980s mortality study with the 1986 U.S. population accidental death and homicide rates. It reflects similar results for males and higher percentages for females.

On the assumption that underwriting individual male accidental death applicants will continue to have the same effectiveness as previously observed, the Basic 1996 ADB Table has been created as a percentage times the population accidental death rates from Table 6. The percentages vary by attained age group. For ages 25–74 the percentages were selected using the calculated percentages in Tables 5 and 7. For ages under 25 and over 80 the percentages were selected to grade into population accidental death mortality, because underwriting at the younger ages is impractical and anyone exposed at the older ages has probably long passed the period in which underwriting has any value.

Given the very low accidental death rate for females and their reduced exposure to occupational and avocational risks, which underwriting eliminates, the percentages of population accidental death rates for females in the Basic 1996 ADB Table are greater than or equal to those for males.

Table 8 shows the calculated basic accidental death rates for ages 0 through 85 and the percentages upon which the calculations are based.

TABLE 8
BASIC 1996 ACCIDENTAL DEATH BENEFITS TABLE
BY AGE GROUPS

Attained Age	Male 1,000 \bar{Q}_x	Female 1,000 \bar{Q}_x	Percentage of Population Rate	
			Male	Female
0–4	0.207	0.157	90.0%	90.0%
5–9	0.086	0.061	80.0	80.0
10–14	0.111	0.056	70.0	70.0
15–19	0.509	0.160	60.0	60.0
20–24	0.506	0.125	50.0	50.0
25–29	0.366	0.122	45.0	55.0
30–34	0.350	0.133	45.0	60.0
35–39	0.327	0.136	45.0	65.0
40–44	0.292	0.134	45.0	70.0
45–49	0.262	0.145	45.0	75.0
50–54	0.271	0.135	50.0	75.0
55–59	0.283	0.143	55.0	75.0
60–64	0.312	0.173	60.0	75.0
65–69	0.367	0.223	65.0	75.0
70–74	0.531	0.325	70.0	85.0
75–79	0.893	0.584	80.0	90.0
80–84	1.734	1.021	90.0	95.0

A valuation accidental death benefits table should be loaded by a factor, whereas a basic table is not. A decision was made to load the basic table by deaths per 1,000 at the key exposure ages (20-64) and then use consistent loadings at the other ages. The loading per 1,000 approach was selected because accidental death experience variations are, in part, random but are probably related to specific actions (that is, exposure to risky situations) by an insured rather than to more general exposure factors.

Table 9 presents the 1996 ADB Mortality Table including the loadings per 1,000 at central ages. For ages 85-100 it was constructed by using estimated population accidental death data to provide age-specific accidental death rates through age 100.

TABLE 9
1996 ACCIDENTAL DEATH BENEFITS MORTALITY TABLE
FOR INDIVIDUALLY UNDERWRITTEN INSURED

Attained Age	1996 Basic ADB Rate		Loading per \$1,000		1996 ADB Table	
	Male 1,000 \bar{Q}	Female 1,000 \bar{Q}	Male	Female	Male 1,000 \bar{Q}	Female 1,000 \bar{Q}
0-4	0.207	0.157	0.100	0.050	0.307	0.207
5-9	0.086	0.061	0.100	0.050	0.186	0.111
10-14	0.111	0.056	0.100	0.050	0.211	0.106
15-19	0.509	0.160	0.100	0.050	0.609	0.210
20-24	0.506	0.125	0.100	0.050	0.606	0.175
25-29	0.366	0.122	0.100	0.050	0.466	0.172
30-34	0.350	0.133	0.100	0.050	0.450	0.183
35-39	0.327	0.136	0.100	0.050	0.427	0.186
40-44	0.292	0.134	0.100	0.050	0.392	0.184
45-49	0.262	0.145	0.100	0.050	0.362	0.195
50-54	0.271	0.135	0.100	0.050	0.371	0.185
55-59	0.283	0.143	0.100	0.050	0.383	0.193
60-64	0.312	0.173	0.100	0.050	0.412	0.223
65-69	0.367	0.223	0.100	0.050	0.467	0.273
70-74	0.531	0.325	0.150	0.100	0.681	0.425
75-79	0.893	0.584	0.200	0.150	1.093	0.734
80-84	1.734	1.021	0.300	0.200	2.034	1.221
85-89	3.161	1.796	0.500	0.300	3.661	2.096
90-94	4.833	2.896	0.750	0.400	5.583	3.296
95-99	6.542	4.077	1.000	0.600	7.542	4.677
100 and over	16.778	5.000	2.000	1.000	18.778	6.000

Table 10 presents the 1996 ADB Mortality Table for individual ages and by sex. The mortality rates for individual ages 2-97 were developed by applying the Jenkins modified 5th difference interpolation formula to the mortality rates in Table 9, assuming that the average age for the age group

TABLE 10
1996 ACCIDENTAL DEATH BENEFITS MORTALITY TABLE FOR
INDIVIDUALLY UNDERWRITTEN INSUREDS

Attained Age	Male 1,000Q _x	Female 1,000Q _x	Attained Age	Male 1,000Q _x	Female 1,000Q _x
0	0.357	0.272	51	0.367	0.187
1	0.332	0.237	52	0.370	0.186
2	0.307	0.207	53	0.372	0.186
3	0.282	0.181	54	0.374	0.186
4	0.256	0.159	55	0.377	0.187
5	0.230	0.139	56	0.380	0.190
6	0.206	0.123	57	0.383	0.193
7	0.186	0.111	58	0.387	0.197
8	0.172	0.102	59	0.392	0.202
9	0.168	0.098	60	0.397	0.208
10	0.175	0.098			
			61	0.403	0.214
11	0.198	0.103	62	0.409	0.221
12	0.239	0.113	63	0.415	0.228
13	0.300	0.130	64	0.423	0.236
14	0.373	0.149	65	0.434	0.245
15	0.450	0.169	66	0.449	0.258
16	0.522	0.186	67	0.470	0.274
17	0.580	0.198	68	0.497	0.294
18	0.617	0.203	69	0.531	0.319
19	0.635	0.201	70	0.572	0.349
20	0.637	0.195			
			71	0.619	0.384
21	0.626	0.188	72	0.673	0.426
22	0.606	0.180	73	0.733	0.474
23	0.581	0.175	74	0.802	0.528
24	0.553	0.172	75	0.884	0.589
25	0.524	0.171	76	0.981	0.656
26	0.498	0.171	77	1.098	0.729
27	0.477	0.172	78	1.236	0.808
28	0.463	0.174	79	1.399	0.895
29	0.454	0.176	80	1.588	0.993
30	0.450	0.178			
			81	1.804	1.103
31	0.448	0.180	82	2.049	1.229
32	0.447	0.182	83	2.325	1.371
33	0.444	0.184	84	2.627	1.530
34	0.441	0.185	85	2.953	1.704
35	0.437	0.185	86	3.298	1.894
36	0.432	0.186	87	3.657	2.098
37	0.426	0.186	88	4.028	2.316
38	0.420	0.185	89	4.408	2.546
39	0.413	0.185	90	4.795	2.786
40	0.406	0.185			
			91	5.187	3.037
41	0.399	0.185	92	5.583	3.296
42	0.392	0.185	93	5.980	3.562
43	0.384	0.187	94	6.377	3.835
44	0.378	0.189	95	6.770	4.112
45	0.372	0.191	96	7.160	4.393
46	0.367	0.192	97	7.542	4.677
47	0.364	0.193	98	7.937	4.964
48	0.363	0.192	99	8.347	5.254
49	0.363	0.191			
50	0.365	0.189			

was the central age for that group. The mortality rates for ages 0, 1, 98, and 99 were manually derived from the interpolated rates.

Except for the younger adult male age groups from 25 to 39, the 1996 ADB Mortality Table shows reduced accidental death mortality rates when compared with the 1959 ADB Mortality Table. This reduction is probably attributable to the increased homicide rate in this general age/sex group.

VI. APPLYING THE 1996 ACCIDENTAL DEATH BENEFITS MORTALITY TABLE

The 1996 ADB Table requires that the actuary assess the type of accidental death benefits business being written. The 1996 ADB Table assumes a level of underwriting that is probably restricted to accidental death programs benefits attached to ordinary life policies.

When any specific block of non-underwritten accidental death business is being reserved by using the 1996 ADB Mortality Table, a modification factor will have to be applied to the death rates to recognize that expected mortality rates exceed those for which the table was developed.

The rating of a block of ADB business involves both subjective and objective factors. For example, if the business is being written on a group that has an increased accidental death risk and a common occupation, it may be possible to use a standard underwriting table to obtain a factor that adjusts the level of mortality. For other blocks of business, an actuary may have to apply a level of judgment that is more subjective than objective when choosing the appropriate modification factor. For most situations the modification factors for moderately or non-underwritten accidental death business will be from 1.5 to 2.5, but some exposures may require greater modification factors.

VII. FUTURE ADB TRENDS

Because almost 50% of deaths from unintentional injuries involve motor vehicles and almost half of motor vehicle deaths are related to alcohol, trends in motor vehicle safety and operation will be directly reflected in accidental death rates [8]. The key factors in determining future levels of motor vehicle deaths will likely be:

- Reduction in drinking and driving incidents
- Increased use of automobile safety devices
- Lower speed limits.

States are lowering the blood alcohol level considered permissible. This is a step toward reducing alcohol-related accidents. Public interest groups, such as Mothers Against Drunk Driving (MADD), are increasing public

awareness of the tragic impact of drinking and driving. Automobile insurance premiums for persons with a history of alcohol-related problems are increased to recognize that such persons have a higher claim risk.

The use of automobile safety devices reduces accidental deaths. Whether more people can be convinced to use safety belts, child restraint devices, and the like is questionable. Some accidental death products provide an additional benefit, if, for example, an insured is killed in an automobile while using a safety belt. However, there is no evidence that this incentive increases the use of safety belts.

Very recently, speed limits on major highways have been increased to 65 mph or higher. Assuming that no other factors change, this increase in speed limits could lead to a higher motor vehicle accidental death rate. In 1974 speed limits on federal highways were reduced to 55 mph to lower fuel consumption because of the reduced petroleum imports from the Near East, and motor vehicle accidental death rates declined by about 20%. If, for example, the higher speed limits resulted in an increase in motor vehicle accidental deaths of a similar magnitude, there could be 5,000 or more additional motor vehicle accidental deaths per year and a 5% or so overall increase in accidental deaths [6].

Another factor that is causing concern about automobile safety and has a direct impact on motor vehicle accidental deaths is the popularity of sport utility vehicles and light trucks. Sport utility and similar vehicles are substantially heavier than traditional family cars. As a result, in an accident between a sport utility vehicle and a typical family car, the occupants of the typical family car are much more likely to be killed because of the weight differential between the vehicles. Put simply, in a crash between two vehicles the occupants of the heavier vehicle have a better chance of surviving [4].

Homicides will continue to be a major problem in the U.S. Various civic and police groups are making concerted efforts to reduce violent crimes and to make the public aware of the past upward trends in homicide rates. There is some evidence that these efforts are working because very recent homicide rates appear to have declined. However, it is impossible to predict whether the level of violence in the U.S. can be curtailed over an extended period and therefore reduce the number of death claims under accidental death policies.

The hope is that the general downward trend in unintentional injuries will continue. On a year-to-year basis, there will be fluctuations in both national and insurance company levels of violent deaths. Therefore, the recommendation is made that the Society of Actuaries annually publish a brief update

of national violent death experience and every 3-4 years confirm the appropriateness of the 1996 ADB Mortality Table as a possible valuation standard.

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APPENDIX

SOURCES OF ADB INFORMATION FOR ACTUARIES

Several sources of accidental-death-related information are available. The following list is not exhaustive but provides an actuary seeking more information about accidental death experience many places in which to begin a search for data.

- The National Safety Council is always an excellent place to start any search for accidental death or other accident-related information. The NSC annually publishes *Accident Facts*, which is almost a “must have” reference in an actuarial library. Copies of *Accident Facts* can be ordered from the NSC at 800-621-7619. The NSC is located at 1121 Spring Lake Dr., Itasca, IL 60143.
- The *Vital Statistics of the United States* is published each year by the U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Health Statistics, Hyattsville, MD. Copies of either *Vital Statistics* or the final reports for other studies can be obtained by contacting the Superintendent of Documents, U.S. Government Printing Office, Mail Stop SSOP, Washington, DC 20402-9328. It sometimes takes several years for the annual statistics to be prepared.
- The *Statistical Bulletin* is a quarterly publication of the Metropolitan Life Insurance Company. This magazine regularly contains analyses of accidental deaths and accidental death trends. Moreover, the sources that these articles cite as references become other excellent sources for other information. To order the *Statistical Bulletin*, write to PO Box 465, Hanover, PA 17331.

More specialized or detailed data regarding accidental deaths are often needed. In such instances it will require digging to find the desired information. Three examples of organizations that can provide this type of information are:

- The Insurance Institute for Highway Safety has additional data on accidental deaths and automobiles. The IIHS can be contacted at 1005 North Glebe Rd., Arlington, VA 22201 (currently 703-247-1500) or on the Internet at “www.hwysafety.org.”

- The National Institute for Occupational Safety and Health is part of the National Centers for Disease Control in Atlanta and is a source for information about on-the-job accidental deaths. NIOSH can be contacted at 800-35NIOSH or on the Internet at "www.cdc.gov/niosh/homepage.html."
- The Bureau of Transportation Statistics collects information on aviation accidents and can be currently reached at 202-366-3282 or on the Internet at "www.bts.gov."

An actuary interested in data on accidental death experience should also consult stories in daily papers such as *The New York Times*, *USA Today*, and so on. Often these publications pick up on studies just released by research groups and provide an excellent source for statistical information. However, it is usually necessary to contact the actual source of the data to get the details and basis of the report.