LIFE TABLES ANALYZED BY CAUSE OF DEATH: SOME METHODOLOGICAL CONSIDERATIONS

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ABSTRACT

The purpose of the study is to test methods concerning construction of cause-eliminated life tables with respect to calculating the value of ${}_nq_x^{(-i)}$ and to adjusting the value of ${}_\infty L_x^{(-i)}$. Comparing the "actuarial" method suggested by Chiang and Greville with the "interaction" method suggested by Krall and Hickman, we find that selection of the method of obtaining ${}_nq_x^{(-i)}$ is not trivial. Alternative methods yield substantially different results. It is also found that the procedure for adjusting ${}_\infty L_x^{(-i)}$ affects the value of $e_0^{(-i)}$ and consequently gain in life expectancy at birth. These two methodological problems are not unrelated. If some adjustment is needed to make gains in life expectancy seem more reasonable, then it seems more appropriate to consider a method which will affect values of functions throughout the life table rather than a single value. The interaction method of calculating ${}_nq_x^{(-i)}$ seems to have promise as such a procedure. This study, however, suggests need for further research to minimize arbitrariness in procedures of calculating life table values.

One question of great interest over several centuries has been that of the impact of certain diseases or conditions on the mortality experience of a population. One method of analyzing mortality is the life table. The life table is a method of depicting the mortality experience of a hypothetical cohort of births subjected to a given set of age-specific mortality rates from birth until the cohort has been entirely depleted by death.

The impact of certain causes of death on the mortality experience of a population may be analyzed through specially constructed cause-eliminated life tables. Methods of constructing life tables with certain causes of death hypothetically eliminated arose historically from investigations of longevity and cause-specific mortality. Initial development of methods for measuring the effect of eliminating certain causes of death was stimulated by the 18th century controversy over the value of small pox inoculation (cf.

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Bernoulli, 1760; D'Alembert, 1768). It was not, however, until over a century later that Makeham (1867) first formulated the law of composition of decremental forces and applied it to the problem of analyzing causes of death. This direct and elemental approach to the problem of hypothetically eliminating a cause of death has served as the basis for subsequent development of procedures for constructing life tables with causes of death eliminated.

The purpose of this study is to empirically test some methodological questions concerning construction of cause-eliminated life tables, particularly with respect to calculation of ${}_nq_x^{(-i)}$, the probability of dying when cause i is eliminated as a cause of death, and to the method of closing out the special life table with causes of death eliminated.

Alternative methods of Calculating ${}_nq_x^{(-i)}$

Construction of life tables with groups of causes of death eliminated rests on determination of three basic values: r_x^i, ${}_nq_x^{(-i)}$, and ${}_nL_x^{(-i)}$.

According to Greville (1948, 285), if u_x^i denotes the instantaneous death rate from cause i and u_x denotes the instantaneous death rate due to all causes, then, following Makeham's law of composition of decremental forces that the total force of mortality is equal to the sum of the partial forces,

$$\sum_{i=1}^{M} u_x^i = u_x. \qquad (1)$$

The relation between values of the partial forces of mortality, u_x^i, in a given age interval and the number of life table deaths is given by

$$r_x^i = u_x^i / u_x \qquad (2)$$

or,

$$u_x^i = r_x^i u_x. \qquad (3)$$

Consequently,

$${}_nd_x^i = r_x^{i*}{}_nd_x \qquad (4)$$

where r_x^i is the proportion of deaths observed in the population in an age interval due to cause i, ${}_nd_x$ is the number of life table deaths due to all causes in the same age interval, and ${}_nd_x^i$ is an estimate of the number of life table deaths due to cause i in the same age interval. r_x^i is estimated by

$$r_x^i = {}_nD_x^i / {}_nD_x \quad (5)$$

where ${}_nD_x^i$ and ${}_nD_x$ are the number of observed deaths due to cause i and due to all causes, respectively, in an age interval. Values of r_x^i are important components in the calculation of alternative methods of estimating ${}_nq_x^{(-i)}$ subsequently compared in this study and are presented in Table 6.

The crucial value to be calculated in construction of any life table is the probability of dying in a given age interval. In cause-eliminated life tables, this value is referred to as ${}_nq_x^{(-i)}$, the probability of dying when cause i is eliminated as a cause of death in the population. Although a number of equations for calculating ${}_nq_x^{(-i)}$ have been suggested, the so-called "actuarial" method has received recent extensive use (Chiang, 1968; Greville, 1973, 1975).

The actuarial method is based on competing risk theory (Chiang, 1968, 242-268). Given an individual alive at age x, his probability of dying in the age interval x to x+n from cause i, ${}_nQ_x^i$, and his probability of surviving the interval, ${}_np_x$, satisfy the conditions

$${}_nq_x = \sum_{i=1}^{M} {}_nQ_x^i \quad (6)$$

and

$$1 = \sum_{i=1}^{M} {}_nQ_x^i + {}_np_x. \quad (7)$$

where ${}_nq_x$ is the probability of dying for all causes combined, ${}_np_x$ is the probability of surviving the age interval (i.e., the complement of ${}_nq_x$), and

$${}_nQ_x^i = r_x^{i*} {}_nq_x. \quad (8)$$

The probability of dying in a given age interval when a cause of death is eliminated is given by

$${}_nq_x^{(-i)} = 1 - {}_np_x^{({}_nq_x - {}_nQ_x^i)/{}_nq_x} \quad (9)$$

Which is estimated by

$$_nq_x^{(-i)} = 1 - {}_np_x^{({}_nD_x - {}_nD_x^i)/{}_nD_x} = 1 - {}_np_x^{1-r_x^i} . \qquad (10)$$

Under the actuarial method, it is assumed that causes of death are completely independent. This, however, is generally not true since a given disease may leave an individual with increased resistance to, or render an individual more susceptible to, some other disease. Users of the actuarial method assume that these factors are difficult to take into account. Thus, the assumption made in the calculation of $_nq_x^{(-i)}$ is that a cause of death has been eliminated but does not mean that the disease or condition has been eliminated. The disease or condition is assumed to continue at the same level that prevailed during the period of observation. However, it is not possible to die from the disease or condition (Bayo, 1968).

Krall and Hickman (1970) question the interrelationships among various causes of decrement within the domain of biology. They argue that if one views cause-of-death analysis as a study of two random variables, time until death and cause of death, it is clear that in general one cannot remove all the probability associated with one or more causes without forcing some redistribution of the probability of dying among the remaining causes. They argue that it may be possible to eliminate a cause of death but given that man is mortal, the probability which was associated with the eliminated cause will, in fact, be taken up by some other cause. Thus, Krall and Hickman suggest their "interaction" method as a means of attacking the problem of redistribution.

Krall and Hickman's equation for estimating $_nq_x^{(-i)}$ is designed to provide for small increases in the remaining forces of mortality when a given cause of death is eliminated. This was felt to be desirable, according to Krall and Hickman, because various causes of death frequently seem to be interacting or competing rather than operating independently. The interaction method suggested by Krall and Hickman is

$$_nq_x^{(-i)} \doteqdot 1 - {}_np_x^{A+BC} \qquad (11)$$

where

$$A = ({}_nq_x - {}_nQ_x^i)/{}_nq_x , \qquad (12)$$

$$B = ({}_nQ_x^i/{}_nq_x) - ({}_nQ_x^i/{}_nq_x)^2 \qquad (13)$$

and

$$C = [(1 - {}_nq_x/2)/(1 - {}_nq_x)]\ {}_nq_x. \qquad (14)$$

It is apparent that A is equivalent to the exponent of ${}_np_x$ in the actuarial method. Thus, the difference between alternative methods lies in the second term of the exponent of ${}_np_x$. This is the result of the additional exposure of lives saved from cause i to the remaining causes. Conseguently, probabilities of dying calculated by the interaction method will always be equal to or greater than those calculated by the actuarial method, resulting in more conservative estimates of life expectancy and gains in life expectancy with elimination of cause i.

Krall and Hickman note that their method of adjusting ${}_nq_x^{(-i)}$ will not result in significantly different values from those obtained with less complicated methods when the probability of dying due to the eliminated cause is small. Krall and Hickman use data on deaths due to specific types of farm accidents to illustrate their contention. However, most studies of cause-eliminated tables are based on the hypothetical elimination of broad groups of causes of death. In this study, a comparison is made between probabilities of dying calculated by alternative methods eliminating, in turn, major cardivascular diseases and motor vehicle accidents as causes of death. Life tables for United States males, 1969-1971, due to all causes of death and those calculated under alternative methods with groups of causes of death eliminated are presented in Tables 1 through 5.

Table 6 presents a comparison of values of ${}_nq_x^{(-i)}$ under alternative methods of calculation. Differences between ${}_nq_x^{(-i)}$ calculated by the interaction method and ${}_nq_x^{(-i)}$ calculated by the actuarial method when major cardiovascular diseases and motor vehicle accidents are eliminated are given in columns (2) and (5). While it may be true, as Krall and Hickman suggest, that elimination of causes of death with small probabilities of dying due to the given cause results in nonsignificant changes in probabilities of dying from remaining causes, values in columns (2) and (5) illustrate that elimination of more prevalent or broader groups of causes results in substantial differences in values of ${}_nq_x^{(-i)}$ calculated under alternative methods, particularly at older ages.

Examination of Tables 2 through 5 reveals that changes in values of ${}_nq_x^{(-i)}$ result in changes in values of life table functions throughout the table. Table 6 presents changes in gains in life expectancy resulting from alternative methods of calculating ${}_nq_x^{(-i)}$. Values in columns (3) and (6) of Table 6 represent differences between gains in life expectancy under alternative methods with elimination of major cardiovascular diseases and motor vehicle accidents as causes of death, respectively. These values show that the interaction

Table 1. Life tables due to all causes of death, United States males, 1969-1971.

Age	${}_nm_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x
< 1	.023340	.023071	100000	2307	97920	6695190	66.95190
1- 4	.000930	.003715	97693	362	390046	6597270	67.53062
5- 9	.000500	.002498	97331	243	486047	6207224	63.77437
10-14	.000507	.002530	97088	245	484825	5721177	58.92773
15-19	.001588	.007909	96843	765	482300	5236352	54.07053
20-24	.002251	.011194	96078	1075	477701	4754052	49.48117
25-29	.002047	.010185	95003	967	472595	4276351	45.01279
30-34	.002283	.011353	94036	1067	467511	3803756	40.45000
35-39	.003134	.015548	92969	1445	461231	3336245	35.88556
40-44	.004780	.023615	91524	2161	452216	2875014	31.41267
45-49	.007461	.036623	89363	3272	438633	2422798	27.11186
50-54	.011692	.056798	86091	4889	418230	1984165	23.04729
55-59	..018347	.087710	81202	7122	388204	1565935	19.28442
60-64	.027666	.129383	74080	9584	346438	1177731	15.89810
65-69	.040925	.185632	64496	11972	292548	831293	12.88906
70-74	.059326	.258318	52524	13567	228700	538745	10.25712
75-79	.087839	.306113	38957	14028	159712	310045	7.95865
80-84	.129368	.488764	24929	12184	94184	150333	6.03045
85+	.226983	1.000000	12745	12745	56149	56149	4.40557

Table 2. Life table eliminating major cardiovascular diseases as a cause of death, United States males, 1969-1971 (actuarial).

Age	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x	Gain
< 1	.022870	100000	2287	97937	7833199	78.33199	11.38010
1- 4	.003592	97713	351	390148	7735262	79.16307	11.63245
5- 9	.002424	97362	236	486219	7345114	75.44127	11.66690
10-14	.002431	97126	236	485037	6858895	70.61852	11.69078
15-19	.007684	96890	744	482587	6373858	65.78447	11.71394
20-24	.010826	96146	1040	478128	5891271	61.27422	11.79305
25-29	.009527	95106	906	473262	5413143	56.91693	11.90414
30-34	.009853	94200	928	468678	4939881	52.44034	11.99034
35-39	.011786	93272	1099	463611	4471203	47.93724	12.05168
40-44	.015442	92173	1423	457306	4007592	43.47902	12.06635
45-49	.021102	90750	1915	448961	3550286	39.12160	12.00974
50-54	.030080	88835	2672	437493	3101325	34.91106	11.86377
55-59	.044567	86163	3840	421214	2663832	30.91618	11.63176
60-64	.063218	82323	5204	398603	2242618	27.24168	11.34359
65-69	.087400	77119	6740	368743	1844015	23.91129	11.02222
70-74	.116165	70379	8175	331455	1475272	20.96181	10.70469
75-79	.156960	62204	9763	286610	1143817	18.38815	10.42951
80-84	.204392	52441	10718	235409	857207	16.34612	10.31567
85+	1.000000	41723	41723	621798	621798	14.90300	10.49744

Table 3. Life table eliminating major cardiovascular diseases as a cause of death, United States males, 1969-1971 (interaction).

Age	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x	Gain
< 1	.022875	100000	2287	97937	7655651	76.55651	9.60461
1- 4	.003593	97713	351	390148	7557714	77.34604	9.81541
5- 9	.002424	97362	236	486219	7167566	73.61769	9.84332
10-14	.002431	97126	236	485037	6681347	68.79050	9.86276
15-19	.007686	96890	744	482587	6196310	63.95200	9.88147
20-24	.010830	96146	1041	478126	5713723	59.42757	9.94640
25-29	.009534	95105	906	473257	5235597	55.05069	10.03790
30-34	.009868	94199	929	468671	4762340	50.55615	10.10616
35-39	.011831	93270	1103	463591	4293669	46.03482	10.14926
40-44	.015560	92167	1435	457246	3830078	41.55585	10.14317
45-49	.021436	90732	1944	448798	3372832	37.17355	10.06169
50-54	.030907	88788	2744	437078	2924034	32.93275	9.88547
55-59	.046580	86044	4007	420201	2486956	28.90331	9.61888
60-64	.067703	82037	5554	396298	2066755	25.19295	9.29485
65-69	.096923	76483	7412	363883	1670457	21.84088	8.95182
70-74	.135377	69071	9350	321978	1306574	18.91638	8.65926
75-79	.196998	59721	11764	269192	984596	16.48659	8.52794
80-84	.286473	47957	13738	205438	715404	14.91761	8.88717
85+	1.000000	34219	34219	509966	509966	14.90301	10.49744

Table 4. Life table eliminating motor vehicle accidents as a cause of death, United States males, 1969-1971 (actuarial).

Age	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x	Gain
< 1	.022970	100000	2297	97928	6788455	67.88455	.93265
1- 4	.003203	97703	312	390186	6690527	68.47821	.94759
5- 9	.001830	97391	178	486509	6300341	64.69119	.91682
10-14	.001907	97213	185	485600	5813832	59.80508	.87735
15-19	.004672	97028	453	484005	5328232	54.91437	.84384
20-24	.006941	96575	670	481199	4844227	50.16025	.67908
25-29	.007423	95905	711	477745	4363028	45.49323	.48044
30-34	.009219	95194	877	473776	3885283	40.81436	.36436
35-39	.013663	94317	1288	468363	3411507	36.17064	.28508
40-44	.021856	93029	2033	460061	2943144	31.63684	.22417
45-49	.034898	90996	3175	447040	2483083	27.28781	.17595
50-54	.055062	87821	4835	427014	2036043	23.18401	.13672
55-59	.085926	82986	7130	397103	1609029	19.38916	.10474
60-64	.127631	75856	9681	355075	1211926	15.97667	.07857
65-69	.183815	66175	12163	300465	856851	12.94826	.05920
70-74	.256386	54012	13847	235439	556386	10.30116	.04403
75-79	.357965	40165	14377	164879	320947	7.99071	.03207
80-84	.486742	25788	12552	97558	156068	6.05196	.02152
85+	1.000000	13236	13236	58510	58510	4.42052	.01495

Table 5. Life table eliminating motor vehicle accidents as a cause of death, United States males, 1969-1971 (interaction).

Age	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x	Gain
< 1	.022972	100000	2297	97928	6785740	67.85740	.90550
1- 4	.003204	97703	313	390184	6687812	68.45042	.91980
5- 9	.001831	97390	178	486504	6297628	64.66400	.88963
10-14	.001908	97212	185	485595	5811124	59.77783	.85010
15-19	.004687	97027	454	483998	5325529	54.88707	.81654
20-24	.006970	96573	673	481181	4841531	50.13338	.65221
25-29	.007443	95900	713	477715	4360350	45.46767	.45488
30-34	.009239	95187	879	473736	3882635	40.78955	.33955
35-39	.013688	94308	1290	468313	3408899	36.14644	.26088
40-44	.021895	93018	2036	459998	2940586	31.61308	.20041
45-49	.034959	90982	3180	446958	2480588	27.26459	.15273
50-54	.055161	87802	4843	426899	2033630	23.16154	.11426
55-59	.086086	82959	7141	396941	1606731	19.36777	.08334
60-64	.127871	75818	9694	354852	1209790	15.95650	.05840
65-69	.184187	66124	12179	300170	854938	12.92931	.04025
70-74	.256968	53945	13862	235067	554768	10.28396	.02684
75-79	.358950	40083	14387	164444	319701	7.97597	.01733
80-84	.488195	25696	12544	97118	155257	6.04207	.01162
85+	1.000000	13152	13152	58139	58139	4.42054	.01497

method yields considerably more conservative estimates of gains in life expectancy than the actuarial method. Differences with respect to elimination of motor vehicle accidents are slight (i.e., .03 year = 10.95 days) but those associated with elimination of major cardiovascular diseases are substantial. These results reveal that selection of the method of calculating ${}_nq_x^{(-i)}$ is not trivial.

Closing Out the Cause-eliminated Life Table

Closing out the cause-eliminated life table refers to the problem of calculating the value of ${}_nL_x^{(-i)}$ for the terminal age interval. Values of ${}_nL_x^{(-i)}$ for all other age intervals in the cause-eliminated life tables presented in Tables 2 through 5 were calculated by

$$ {}_nL_x^{(-i)} = (n - {}_nf_x)l_x^{(-i)} + {}_nf_x * l_{x+n}^{(-i)} \qquad (15)$$

where

$$ {}_nf_x = (nl_x - {}_nL_x) / (l_x - l_{x+n}) \qquad (16)$$

where values of n, l_x, l_{x+n}, and ${}_nL_x$ were taken from the life tables for all causes.

The terminal age interval is a half open age interval. Thus, equation (15) may not be used because the value of n is indeterminate. The value of ${}_\infty L_{85}^{(-i)}$ was calculated by

$$ {}_\infty L_{85}^{(-i)} = [e_{85}\, l_{85}^{(-i)}] / (1 - r_{85}^i) \qquad (17)$$

where e_{85} is life expectancy at age 85 from the life table for all causes, $l_{85}^{(-i)}$ is the number of survivors to the terminal age interval from the cause-eliminated table, and r_{85}^i is the proportion of deaths due to cause i in the terminal age interval.

Recent studies (cf. Siegel, 1976; Greville, 1975) indicate that corrective adjustments for cause-eliminated tables are necessary for the procedure used to close out the table. Greville (1975) suggests that the equation

$$ {}_\infty L_{85}^{(-i)} = [e_{85}\, l_{85}^{(-i)}] / (1 - r_{x-z}^i) \qquad (18)$$

be used where r_{x-z}^i is some value of r_x^i other than r_{85}^i. However, two problems arise. First, no explanation is given for the necessity of adjustments. Second, the selection

Table 6. Proportion of deaths due to eliminated causes and changes in probability of dying and gain in life expectancy under alternative methods.

	Eliminated cause					
	Cardiovascular Diseases			Motor Vehicle Accidents		
Age	r_x^i	Change[a] in ${}_nq_x^{(-i)}$	Change in gain	r_x^i	Change in ${}_nq_x^{(-i)}$	Change in gain
	(1)	(2)	(3)	(4)	(5)	(6)
< 1	.008792	.000005	1.77549	.004408	.000002	.02715
1- 4	.032935	.000001	1.81704	.138021	.000001	.02779
5- 9	.29724	.000000	1.82358	.267717	.000001	.02719
10-14	.039198	.000000	1.82802	.246331	.000001	.02725
15-19	.028495	.000002	1.83247	.410295	.000016	.02730
20-24	.033033	.000004	1.84665	.381270	.000029	.02687
25-29	.064899	.000007	1.86624	.272265	.000021	.02556
30-34	.132705	.000015	1.88418	.188810	.000020	.02481
34-39	.243381	.000045	1.90242	.122100	.000026	.02420
40-44	.348821	.000128	1.92318	.075321	.000039	.02376
45-49	.428367	.000334	1.94805	.047960	.000061	.02322
50-54	.477697	.000827	1.97830	.031434	.000099	.02246
55-59	.503360	.002013	2.01288	.021289	.000160	02140
60-64	.528667	.004485	2.04874	.014515	.000240	.02017
65-69	.554610	.009522	2.07040	.010857	.000372	.01895
70-74	.586780	.019212	2.04543	.008706	.000581	.01719
75-79	.617570	.040038	1.90157	.007508	.000985	.01474
80-84	.659203	.082081	1.42850	.005884	.001453	.00990
85+	.704384	.000000	0.00000	.003398	.000000	.00000

a-Changes indicated in columns 2, 3, 5, and 6 refer to differences between values calculated by the actuarial method and values calculated by the interaction method. The probability of dying calculated by the interaction method will always be equal to or greater than the probability of dying calculated by the actuarial method. Thus, estimates of gains in life expectancy under the interaction method will always be equal to or less than those obtained under the actuarial method.

of r^i_{x-z} appears arbitrary.

It can be shown that values of ${}_{\infty}L^{(-i)}_{85}$ and $e^{(-i)}_x$ can be manipulated by selection of r^i_{x-z}. Table 7 presents values of ${}_{\infty}L^{(-i)}_{85}$ calculated using arbitrarily selected values of r^i_{x-z}, differences between values of ${}_{\infty}L^{(-i)}_{85}$ calculated using r^i_{85} and those calculated using alternative values of r^i_{x-z}, and the impact of alternative values of r^i_{x-z} on $T^{(-i)}_0$, $e^{(-i)}_0$, and gains in life expectancy at birth due to alternative values of r^i_{x-z}. Again, selection of the value of r^i_{x-z} to be used has a significant effect on results obtained.

Conclusion

This study addressed two methodological problems in the construction of life tables with causes of death eliminated. First, it was shown that in the construction of life tables with broad groups of causes of death eliminated, selection of the method of calculating ${}_nq^{(-i)}_x$ is not trivial. Alternative methods yield substantially different results.

Second, it was shown that the procedure for "adjusting" the value of ${}_{\infty}L^{(-i)}_{85}$ affects the value of $e^{(-i)}_0$ and consequently the value of gain in life expectancy at birth. The questions of the necessity of adjustment and the nature of that adjustment must be clarified.

These two problems are not unrelated. If some adjustment needs to be made to make gains in life expectancy seem more reasonable, then it seems more appropriate to consider a method which will affect values of functions throughout the life table rather than a single value. Krall and Hickman's interaction method of calculating ${}_nq^{(-i)}_x$ has promise as such a procedure. This method yields more conservative results than the actuarial method. More importantly, however, it is based on assumptions which are not contrary to biological considerations. Further research, however, is needed to minimize arbitrariness in calculating life table values.

Table 7. Values of ${}_{\infty}L_{85}^{(-i)}$ under alternative values of r_{x-z}^{i} and changes in ${}_{\infty}L_{85}^{(-i)}$, $T_0^{(-i)}$, $e_0^{(-i)}$, and gain in life expectancy, major cardiovascular diseases eliminated as a cause of death, United States males, 1969-1971.

	e_{85}^{a}	$l_{85}^{(-i)b}$	${}_{\infty}L_{85}^{(-i)}$	Change in ${}_{\infty}L_{85}^{(-i)}$ 621798^{b} – (4)	$T_0^{(-i)}$	$e_0^{(-i)}$	Gain
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
r_{85}^{i} = .704384	4.40557	41723	621798	–	–	78.33199	11.38010
r_{80}^{i} = .659203	4.40557	41723	539363	82435	7750764	77.50764	10.55574
r_{75}^{i} = .617570	4.40557	41723	480646	141152	7692047	76.92047	9.96857
r_{70}^{i} = .586780	4.40557	41723	444832	176966	7656233	76.56233	9.61043
r_{65}^{i} = .554610	4.40557	41723	412702	209096	7624103	76.24103	9.28913

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死因生命表的分析：方法的斟酌

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中文摘要

在原理上，生命表以製作可以把某一（數）種死亡原因剔除，以瞭解該死因對平均命的影響。在製作這種生命時，死亡機率〔$_{n}q_{x}^{(-i)}$〕和靜態人口〔$_{\infty}L_{x}^{(-i)}$〕的計是兩個重要課題。本文比較死亡機率（剔除死因 i 以後）的兩種計算方法，不同方法產不同結果。此外靜態人口（剔除 i 以後）的計算影響平均餘命和死因剔除後餘命的增加本文作者認爲克羅（Krall）及希曼（Hickman）兩氏提議的「交往法」較爲合用，方面所研究尚待探討改進之處仍多。

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