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PRICING OF ACCELERATED BENEFIT PLANS

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ABSTRACT

Some of the newest products on the market today "accelerate" the death benefit by paying a portion of the benefit before death under certain prescribed conditions. The more common of these products are long-term-care and dread disease riders to life policies. This paper presents generic formulas for calculating the cost of morbidity that would be multiplied by the policy's net amount at risk in an asset share pricing calculation.

LONG-TERM-CARE PRODUCT

A long-term-care (LTC) rider attached to a life product typically pays a monthly stipend during nursing home confinement. The ultimate death benefit is then reduced by the cumulative amount of monthly payments. Various requirements about the facility and the type of care involved must be met to trigger a benefit payment. Normally, there are an elimination period and a maximum payment amount. In addition, many products waive the cost of insurance during confinement. Many variations of these products are available today, and undoubtedly more will be developed in the future.

This paper examines the calculation of the cost of morbidity for a generic universal life LTC rider. This generic rider pays 2 percent of the death benefit per month of continued confinement after confinement exceeds a certain number of months. With each LTC payment, all policy values are proportionally reduced (that is, each 2 percent LTC payment reduces the account value, the initial stated amount, and any outstanding loan by 2 percent). Benefits are exhausted 25 months after the elimination period (that is, after one-half of the initial stated amount has been paid). This generic policy also waives the cost of insurance while benefits are being paid.

Although variations exist about the account value reduction, including leaving that to the policyholder's discretion, the formulas calculate the cost of morbidity to be multiplied by the net amount at risk. Once the percentage payout of net amount at risk has been determined, the reduction in account value is immaterial. To modify the formulas to calculate costs of morbidity to be multiplied by the face amount, the account value (either explicit in universal life products or implicit in traditional permanent products)

reduction is relevant and the formulas need to reflect the release of reserves on payment.

LTC General Formula

The generalized formula for a month's payment comprises three components. The first component is the payment itself, 0.02. The second represents the waiving of the cost of insurance on a reduced net amount at risk; for the first month's payment, this is 0.98 times the cost of insurance. The third component is the death benefit savings. This savings reflects the reduction of the specified amount on a presumably substandard life who is still paying standard rates. In other words, we assume that individuals who enter a nursing home are in worse health than typical point-in-time policyholders. The death benefit savings can be considered a type of net single premium for the difference between a substandard q_x and a standard q_x. If entry into the nursing home were totally random and had nothing to do with mortality, then the death benefit savings would be equal to zero. If mortality were equal to 1.0 upon entering a nursing home, then the death benefit savings should be equal to, and would offset, the payment of 0.02. Expressed as a general formula, the cost of the first month's payment is:

$$(0.02) + (0.98 \times COI) - (0.02 \times DBS)$$

where

COI = cost of insurance (includes all policy charges being waived, including the cost of this rider)
DBS = death benefit savings, ranging from 0 to 1.

Specific Formula

The specific formula presented calculates issue age and durational costs of morbidity. The cost of morbidity is the present value (at the time of entry into the nursing home) of the various monthly payments. The formula below assumes that the data are given in the format of Tables B1 and B2 in the 1985 Nursing Home Study. Leong's article, entitled "Nursing Home Utilization Based on the 1985 National Nursing Home Survey," is attached as Appendix B. Table B1 shows the incidence of entry by attained age. Modifications needed to reflect insured lives and to account for risk selection are discussed later.

Let $P^1_{x,d}$ represent the probability of entering a nursing home, at issue age x and duration d. Table B1 also provides the probability of length of stay

matrix. This matrix breaks the length of stay for each entry age group into ten cells ranging from 1 to 10 days for the first cell to greater than 36 months for the last cell.

Let $P^2_{x+d-1,t}$ represent the probability of staying in a nursing home for a length of time within cell t, assuming entry at attained age $x+d-1$. Table B2 shows the average length of stay. This matrix contains the average length of stay for each of the cells in the probability of length of stay matrix.

Let $L_{x+d-1,t}$ represent the length of stay expressed in months for someone who enters at attained age $x+d-1$ and stays for a length of time within cell t.

The morbidity cost equals

$$P^1_{x,d} \times \sum_{t=f+1}^{10} P^2_{x+d-1,t} \times \sum_{j=e+1}^{m} v^j \Bigg(0.02 + \Big\{\Big[1 - (j-e) \times 0.02\Big] \times COI_{x+d-1+j/12}\Big\} - \Big\{0.02 \Big[\sum_{k=0}^{\infty} v^{k+1} \times {}_kp^{SB}_{x+d-1+j/12} \times \Big(q^{SB}_{x+d+k-1+j/12} - q^{ST}_{x+d+k-1+j/12}\Big)\Big]\Big\}\Bigg)$$

where $P^1_{x,d}$, $P^2_{x+d-1,t}$, and $L_{x+d-1,t}$ have been defined above and

$t=1$	=	1–10 days
$t=2$	=	11–20 days
$t=3$	=	21–30 days
$t=4$	=	31–90 days
$t=5$	=	91–180 days
$t=6$	=	181–270 days
$t=7$	=	271–365 days
$t=8$	=	12–24 months
$t=9$	=	25–36 months
$t=10$	=	>36 months
m	=	min $(L_{x+d-1,t}; 25+e)$
i	=	interest rate
v	=	$1/(1+i)$
e	=	elimination period expressed in months
f	=	elimination period expressed as variable t
$COI_{x+d-1+j/12}$	=	current COI at attained age $x+d-1+j/12$

k = period since entry into the nursing home in years

${}_kP^{SB}_{x+d-1+j/12}$ = probability that $(x+d-1)$ survives and persists to $(x+d+k-1)$ for a substandard (SB) life (Although lapsation is a possibility on a substandard life, one could reason that the rate of lapsation would be extremely low.)

$q^{SB}_{x+d+k-1+j/12}$ = probability that $(x+d+k-1)$ dies in the next year for a substandard (SB) life

$q^{ST}_{x+d+k-1+j/12}$ = probability that $(x+d+k-1)$ dies in the next year for a standard (ST) life.

The part of the formula to the left of the second summation sign reflects the probability of the insured's entering the nursing home and remaining there for one of the 10 cell-periods of time. In addition, the first summation sign removes those stays that are shorter than the elimination period. The remainder of the formula is the present value of the monthly payments for the particular cell-period that we are in, valued at the time of entry into the nursing home—not as of the point of issue. This part of the formula sums from the end of the elimination period in months to however long payments are made. The payments continue until the insured leaves the nursing home ($L_{x+d-1,j}$) or until benefits have been exhausted ($e+25$). After the summation sign are three terms. The first, 0.02, is the monthly payment made to the policyholder. The second term provides for waiving the cost of insurance, where the amount of insurance is 98 percent the first month, 96 percent the second month, 94 percent the third month, and so forth. Because the cost of insurance changes on each policy anniversary, the amount being waived changes on policy anniversary; hence the subscript on the COI term is expressed as $x+d-1+j/12$. The third term, which is subtracted, is the death benefit savings referred to in the general formula section. Again, this is due to the reduction of the stated amount on a presumably substandard insured who is paying standard rates. This death benefit savings is a net single premium for the difference between the substandard q_x's and the standard q_x's. The death benefit savings is developed further in Appendix A.

Incidence and Length-of-Stay Assumptions

The data in the 1985 Nursing Home Study need some modification. As Leong mentions, the tables assume one admission per user in any 12-month period. This overstates the incidence rates and slightly understates the length of stay. Estimates are needed to adjust for the overstatement of incidence and a corresponding convolution of the probability of length of stay matrix.

Some smoothing of the data may be useful because certain cells have limited exposure and lack statistical credibility.

Other modifications are necessary because the study is of population data instead of insured data. Effects of the following should be considered:

1. Underwriting Selection. Depending on the extent of underwriting, early duration incidence would be reduced.
2. Antiselection. The extent to which the availability of coverage would attract higher-risk applicants.
3. The Existence of Coverage. Incidence rates and length of stay may be adversely affected by individuals utilizing coverage and staying longer because they have it.
4. Policy Features, Limits, Exclusions, Waiting Period, Payments and Conditions. All these should be considered for their effect on the incidence and length of stay.
5. AIDS. Because this epidemic was not fully reflected in the period of study, incidence rates would need to be increased, particularly at certain ages.

Example

For ease of illustration, the assumptions are directly from the 1985 Nursing Home Study without modification as described previously.

The example below determines the costs of morbidity, to be multiplied by the net amount at risk, for a male issue age 55 and duration 6. Assume the following:

$$P^1_{55,6} = 0.004815$$

$$P^2_{55+6-1,t} = \begin{array}{l} 0.068756 \text{ for } t=1 \\ 0.101353 \text{ for } t=2 \\ 0.007080 \text{ for } t=3 \\ 0.250219 \text{ for } t=4 \\ 0.191435 \text{ for } t=5 \\ 0.132316 \text{ for } t=6 \\ 0.005907 \text{ for } t=7 \\ 0.116269 \text{ for } t=8 \\ 0.051828 \text{ for } t=9 \\ 0.074831 \text{ for } t=10 \end{array}$$

$L_{55+6-1,t}$ = 6/30 = 0 months for $t=1$
16/30 = 1 month for $t=2$
27/30 = 1 month for $t=3$
57/30 = 2 months for $t=4$
133/30 = 4 months for $t=5$
208/30 = 7 months for $t=6$
319/30 = 11 months for $t=7$
517/30 = 17 months for $t=8$
822/30 = 27 months for $t=9$
2794/30 = 93 months for $t=10$

e = 24 months (unrealistic, but it simplifies the example)

f = 8.

The 1975–80 Basic Tables are assumed in calculating mortality and survival rates. Substandard mortality is assumed to be 200 percent of standard mortality in this example. Thus the cost of morbidity for a male issue age 55 duration 6 would be:

$$0.004815 \times \left(0.051828 \times \sum_{j=25}^{27} A + 0.074831 \times \sum_{j=25}^{49} A\right)$$

where

$$A = 0.02 + \left\{[1 - (j - 24) \times 0.02] \times COI_{55+6-1+j/12}\right\} - \left\{0.02 \left[\sum_{k=0}^{\infty} v^{k+1} \times {}_kp^{SB}_{55+6-1+j/12} \times (q^{SB}_{55+6+k-1+j/12} - q^{ST}_{55+6+k-1+j/12})\right]\right\}.$$

For $j=25$,

$$A = 0.02 + 0.98 \times COI_{62} - \left[0.02 \left(\sum_{k=0}^{\infty} v^{k+1} \times {}_kp^{SB}_{55+6-1+2}\right) \times \left(q^{SB}_{55+6+k-1+2} - q^{ST}_{55+6+k-1+2}\right)\right]$$

The final component, the death benefit savings, is extremely time-consuming, but relatively easy to program on a computer. By using a select and

ultimate table such as the 1975–80 Basic Table, a few more lines of programming are added as ${}_kp_{55+6-1+2}$ is the probability of an individual age 55 duration 8 surviving k additional years.

DREAD DISEASE PRODUCT

As with the LTC rider, dread disease riders are entering the marketplace with many variations. Typically, the dread disease riders pay a one-time portion of the stated amount upon occurrence of one of several "dread diseases." For this paper, the generic policy pays 25 percent of the stated amount, one-time-only, upon occurrence of a dread disease. After the one-time payment, all policy values are reduced to 75 percent of their original value.

Dread Disease Data

The assumed incidence rates and extra mortality associated with each of the dread diseases that the product covers are difficult to determine. An article by Mast* may assist in determining the rate of incidence and mortality associated with each of the dread diseases. Once these have been determined, the incidence rates are summed. In addition, the extra mortality needs to be averaged and weighted according to the incidence of each of the dread diseases. Sample assumptions for five of the common dread diseases follow, indicating estimates of the incidence rates and the extra first-year death rates at age 55 for a male nonsmoker and smoker.

SAMPLE MALE ASSUMPTIONS AT AGE 55

	Heart Attack	Bypass	Stroke	Cancer	Renal Failure	Total	
Incidence Rates per 1000							
Nonsmoker	3.98	1.06	1.14	4.67	1.11	11.96	
Smoker	8.79	2.33	1.77	10.60	1.11	24.60	
Extra First-Year Deaths per 1000							
						Average	
						NS	SM
	150	55	250	350	150	229	235

*MAST, JESS. "Pricing Dread Disease Benefits: A Pathway for Developing Incidence and Survival Assumptions," *Reinsurance Reporter*, Issue 119 (Winter 1989): 17–23.

Formula

The dread-disease formula is similar to the LTC rider formula, but has a simpler format. There are the payment of 25 percent of the stated amount and a death benefit savings that corresponds to the reduction of the stated amount on a presumably substandard insured.

$$P^1_{x,d} \times \left\{0.25 - 0.25 \left[\sum_{k=0}^{\infty} v^{k+1}\, {}_kp^{SB}_{x+d-1} \times (q^{SB}_{x+d+k-1} - q^{ST}_{x+d+k-1})\right]\right\}$$

where

$P^1_{x,d}$ = probability of onset at issue age x, duration d

k = period since onset of dread disease in years

i = interest rate

${}_kp^{SB}_{x+d-1}$ = probability that $(x+d-1)$ survives to $(x+d+k-1)$ for a substandard (SB) life

$q^{SB}_{x+d+k-1}$ = probability that $(x+d+k-1)$ dies in the next year for a substandard (SB) life

$q^{ST}_{x+d+k-1}$ = probability that $(x+d+k-1)$ dies in the next year for a standard (ST) life.

The formula is greatly simplified from the LTC rider as a single payment is made at the occurrence of the disease, rather than a series of payments made for the duration of the insured's stay in a nursing home. The formula multiplies the probability of onset of one of the dread diseases by 0.25 for the payment to the policyholder and subtracts 0.25 times the death benefit savings. The death benefit savings can be considered to be a net single premium for the difference between a substandard q_x and the standard q_x.

Present Value at Time of Issue

If it is desired to calculate a present value of the cost of morbidity at the time of issue, then discount the above present values (as of onset of dread disease or time of entering a nursing home) for interest, mortality, and lapse, summing over all durations.

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APPENDIX A

The death benefit savings entails examining the reserve that is being held, and the reserve that should be held, with the knowledge that the policyholder is now substandard. The reserve that is being held is:

$$ {}_dV_x = A^{ST}_{x+d} - P^{ST}_x \, a^{ST}_{x+d}. $$

The reserve that should be held on the substandard individual paying standard rates is:

$$ A^{SB}_{x+d} - P^{ST}_x \, a^{SB}_{x+d}. $$

The death benefit savings is the difference between these two, because the death benefit is reduced upon payment of the long-term-care (or dread disease) rider. A special case, which makes this easier to visualize, is a paid-up policy. The difference then reduces to:

$$ A^{SB}_{x+d} - A^{ST}_{x+d} $$

With a whole life policy that portionally reduces the cash value, the reserve (A^{ST}_{x+d}) would be released, resulting in a total cost, for each $1 of payment of:

$$ 1 - A^{SB}_{x+d} $$

Universal Life is like an annual renewable term policy in that the internal cost of insurance rates are not level (as with a whole life premium) but change each policy year. Thus the death savings changes from:

$$ (A^{SB}_{x+d} - P^{ST}_x \, a^{SB}_{x+d}) - (A^{ST}_{x+d} - P^{ST}_x \, a^{ST}_{x+d}) $$

or

$$ \left(\sum_{k=0}^{\infty} v^{k+1} \, {}_kp^{SB}_{x+d-1} \, q^{SB}_{x+d+k-1} - P^{ST}_x \sum_{k=0}^{\infty} v^k \, {}_kp^{SB}_{x+d+k-1} \right) $$
$$ - \left(\sum_{k=0}^{\infty} v^k \, {}_kp^{ST}_{x+d-1} \, q^{ST}_{x+d+k-1} - P^{ST}_x \sum_{k=0}^{\infty} v^k \, {}_kp^{ST}_{x+d+k-1} \right) $$

to

$$ \left(\sum_{k=0}^{\infty} v^{k+1} \, {}_kp^{SB}_{x+d-1} \, q^{SB}_{x+d+k-1} - \sum_{k=0}^{\infty} v^{k+1} \, {}_kp^{SB}_{x+d+k-1} \, q^{ST}_{x+d+k-1} \right) $$
$$ - \left(\sum_{k=0}^{\infty} v^{k+1} \, {}_kp^{ST}_{x+d-1} \, q^{ST}_{x+d+k-1} - \sum_{k=0}^{\infty} v^{k+1} \, {}_kp^{ST}_{x+d-1} \, q^{ST}_{x+d+k-1} \right) $$

which reduces to

$$\sum_{k=0}^{\infty} v^{k+1}\, {}_kp^{SB}_{x+d-1}\,(q^{SB}_{x+d+k-1} - q^{ST}_{x+d+k-1}).$$

One may conceptualize this as the present value (with interest and survivorship) of the difference between what the newly substandard policyholder should pay and what the policyholder would pay.

APPENDIX B

NURSING HOME UTILIZATION BASED ON THE 1985 NATIONAL NURSING HOME SURVEY*

KENNETH K. LEONG

The Office of the Actuary of the Health Care Financing Administration has developed a set of tables related to nursing home utilization based on the 1985 National Nursing Home Survey. Nursing home is defined as any facility that provides nursing and/or custodial care. Facility that provides only room and board is excluded from the survey.

The data used to construct these tables come from two small files extracted from the 1985 National Nursing Home Survey by the National Center for Health Statistics. The Current Resident File contains information on residents who were in nursing homes on the day prior to the survey dates. The Discharged Resident File contains information on those nursing home residents discharged within 12 months prior to the survey dates. A description of the survey is available from NCHS.

Because of the limited amount of information included in the two extracts used to generate the following tables, it is not possible to differentiate between nursing care and custodial care. One should be able to do that when the public use tape is available.

Table B1 shows the incidence rates of entering a nursing home within a 12-month period by age and sex. The numerator is the number of admissions within 12 months prior to the survey dates from both the Current Resident and the Discharged Resident Files. The denominator is the census population in the same age-sex category. These rates represent the probabilities of an individual entering a nursing home within a 12-month period. The table also shows probabilities by length of stay. These are probabilities that an individual will spend a specific number of days in nursing homes once he is

*This article originally appeared in *Health Section News*, May 1988, pp. 14–19.

admitted. These probabilities are derived from data in the Discharged Resident file.

Table B2 shows the average length of stay associated with each age-sex length of stay cell in Table B1.

Table B3 is derived from Table B1. Instead of the probability of length of stay in a certain interval, Table B3 shows the probabilities of length of stay over a certain number of days.

It would be highly desirable to have more detailed breakdowns than those shown in Table B1. However, the small sample size severely limits the maximum number of cells that can be used. A reasonable compromise is to have a finer breakdown in one parameter while at the same time reduce that of another parameter such as Table B4. Table B4 shows the number of admissions for length of stay of 1 day, 2 days and so forth in increments of 1 day, up to 30 days for all ages combined.

Table B5 is derived from Table B3. It shows the number of admissions and nursing home days over a series of thresholds.

Implicit in these tables is the assumption of one admission per user in any given 12-month period. This is a major constraint in the National Nursing Home Survey. There is no way to relate multiple admissions to an individual. This one-admission-per-user assumption would result in an overstatement in the incidence rates which is offset to some extent by an understatement in the length of stay. The offset may not be complete. It does, however, reduce the impact of the lack of multiple admission data on the claim cost estimate.

The tables were derived from raw data. No graduation was done to improve the smoothness of the derived numbers. Some of the numbers are not very credible because of the small number of patients in those cells.

TABLE B1

INCIDENCE RATES AND PROBABILITIES OF LENGTH OF STAY (BASED ON 1985 NATIONAL NURSING HOME SURVEY)

Entry Age	Incidence Rate	Probability of Length of Stay										
		1–10 Days	11–20 Days	21–30 Days	31–90 Days	91–180 Days	181–270 Days	271–365 Days	12–24 Months	25–36 Months	>36 Months	All Durations
MALE												
<45	.000321	.183745	.090271	.028488	.241829	.119446	.042980	.085847	.149307	.020327	.037755	1.000000
45–49	.002151	.480556	.144752	.018124	.166007	.044241		.009721	.027269		.109326	1.000000
50–54	.001899	.267624	.063968	.065274	.235087	.006627	.060052	.066077	.097609	.057742	.079935	1.000000
55–59	.003452	.086926	.173798	.119811	.217395	.059932	.057522	.041561	.049167	.019495	.174388	1.000000
60–64	.004815	.068756	.101353	.007080	.250219	.191435	.132316	.005907	.116269	.051828	.074831	1.000000
65–69	.007647	.135054	.072548	.093063	.157723	.128459	.080568	.097769	.067344	.039604	.127862	1.000000
70–74	.018018	.155060	.047748	.143654	.205357	.134582	.079990	.030869	.086905	.025451	.090380	1.000000
75–79	.040686	.172304	.089324	.148071	.143014	.109411	.090175	.032102	.101435	.043835	.070325	1.000000
80–84	.078467	.156329	.095960	.100148	.238462	.109166	.071458	.028341	.082537	.045199	.072395	1.000000
85–89	.120940	.198287	.090697	.075917	.195356	.090419	.080376	.042502	.098071	.059657	.068713	1.000000
90–94	.169005	.167773	.132030	.062204	.156432	.146198	.062941	.058977	.122718	.026154	.064570	1.000000
95–99	.286672	.052444	.103962	.053062	.449602	.120954	.032671	.069436	.062331	.020159	.035374	1.000000
>99	.130452	.045002	.346415	.187336	.151753	.190476		.079016				1.000000
Total	.004089	.166086	.094130	.095772	.203667	.113097	.074604	.042231	.092616	.039008	.078785	1.000000
FEMALE												
<45	.000124	.180947	.032181	.044027	.125074	.140572	.064363	.068706	.136327	.082823	.124975	1.000000
45–49	.000796	.079578	.019578	.184421	.150105	.117684	.026105	.017052	.102947	.067789	.234736	1.000000
50–54	.001133	.127996	.069246	.013003	.301738	.153376	.082093		.080683		.171862	1.000000
55–59	.001707	.096434	.046000	.027974	.323877	.051122	.040484	.013297	.130811	.108451	.161544	1.000000
60–64	.004158	.069987	.088302	.094144	.276385	.116106	.055525	.029130	.104835	.042265	.123316	1.000000
65–69	.010204	.089039	.125497	.108061	.234088	.068937	.054274	.041007	.086584	.084109	.108400	1.000000
70–74	.020786	.105355	.115668	.072094	.209531	.122837	.059423	.037952	.091160	.050944	.135031	1.000000
75–79	.042975	.091449	.111644	.073167	.243305	.111880	.042713	.049754	.094727	.064871	.116486	1.000000
80–84	.095041	.130661	.110448	.064454	.201322	.101633	.074741	.041711	.076394	.052504	.146125	1.000000
85–89	.140816	.118131	.075028	.065850	.203871	.112942	.056625	.067733	.106096	.067465	.126254	1.000000
90–94	.195326	.148353	.093384	.057510	.178549	.095797	.076497	.046565	.122368	.064878	.116094	1.000000
95–99	.208949	.165909	.032599	.039396	.239396	.175897	.041824	.056632	.097693	.072758	.077891	1.000000
>99	.138026	.047292	.039132	.095511	.242396	.209940		.035422	.245734	.067507	.017062	1.000000
Total	.006900	.117779	.096272	.068340	.213360	.109224	.060376	.048183	.097426	.061983	.127052	1.000000

TABLE B1—*Contined*

Entry Age	Incidence Rate	Probability of Length of Stay										
		1–10 Days	11–20 Days	21–30 Days	31–90 Days	91–180 Days	181–270 Days	271–365 Days	12–24 Months	25–36 Months	>36 Months	All Durations
						MALE AND FEMALE						
<45	.000222	.182966	.074083	.032818	.209292	.125333	.048939	.081070	.145690	.037743	.062061	1.000000
45–49	.001455	.367775	.109545	.064898	.161534	.064898	.007342	.011783	.048555	.019066	.144599	1.000000
50–54	.001503	.213083	.066030	.044856	.261122	.063949	.068661	.040266	.090998	.035187	.115843	1.000000
55–59	.002538	.090275	.128786	.087464	.254900	.056829	.051521	.031606	.077923	.050827	.169864	1.000000
60–64	.004461	.069375	.094791	.050854	.263375	.153562	.093708	.017583	.110520	.047020	.099208	1.000000
65–69	.009028	.105969	.104864	.102217	.204331	.092131	.064520	.063125	.079087	.066767	.115984	1.000000
70–74	.019581	.125264	.088463	.100756	.207859	.127541	.067661	.035115	.089456	.040733	.117147	1.000000
75–79	.042065	.122538	.103062	.101967	.204743	.110930	.060962	.042967	.097306	.056782	.098737	1.000000
80–84	.089183	.138643	.105942	.075554	.212872	.103976	.073720	.037553	.078305	.050233	.123197	1.000000
85–89	.134742	.140118	.079326	.068611	.201536	.106764	.063140	.060812	.103895	.065323	.110471	1.000000
90–94	.188253	.153038	.102707	.058642	.173213	.107957	.073227	.049559	.122453	.055535	.103664	1.000000
95–99	.228113	.130750	.054712	.043631	.304533	.158872	.038988	.060600	.086735	.056459	.064716	1.000000
>99	.135960	.046693	.119539	.119539	.218677	.204847		.046830	.181432	.049842	.012597	1.000000
Total	.005536	.135095	.095504	.078173	.209885	.110613	.065476	.046050	.095702	.053747	.109750	1.000000

TABLE B2

DISTRIBUTION OF ADMISSIONS BY AGE AND ASSOCIATED AVERAGE LENGTH OF STAY IN DAYS
(BASED ON 1985 NATIONAL NURSING HOME SURVEY)

Entry Age	Number of Admissions	Length of Stay										
		1–10 Days	11–20 Days	21–30 Days	31–90 Days	91–180 Days	181–270 Days	271–365 Days	12–24 Months	25–36 Months	>36 Months	All Durations
MALE												
<45	26,221	4	17	24	61	142	237	326	479	830	3931	310
45–49	12,138	6	14	29	54	146		352	425		1795	232
50–54	9,958	7	15	25	52	180	216	317	529	977	4323	505
55–59	18,671	7	15	25	67	145	264	323	514	893	3177	655
60–64	23,867	6	16	27	57	133	208	319	517	822	2794	383
65–69	30,173	6	16	26	56	124	221	319	494	959	2355	451
70–74	56,107	4	17	25	53	128	216	317	567	892	1952	309
75–79	84,635	5	15	25	54	128	220	316	506	882	2703	338
80–84	91,704	5	15	25	56	139	222	320	511	887	2063	290
85–89	64,820	6	16	24	57	133	223	325	503	927	1834	290
90–94	32,538	6	17	28	57	139	241	322	473	897	1616	254
95–99	12,947	4	15	25	47	133	237	333	565	959	1822	190
>99	1,911	2	18	26	53	92		345				64
Total	465,696	5	16	25	56	133	223	322	509	898	2350	329
FEMALE												
<45	10,130	3	14	29	63	147	228	341	440	884	3298	614
45–49	4,750	1	20	25	37	123	205	304	596	1022	1926	618
50–54	6,383	5	18	22	51	157	202		558		4587	892
55–59	10,152	5	18	25	63	127	230	289	503	891	2534	614
60–64	24,133	3	16	26	56	132	254	332	482	914	2465	452
65–69	47,260	5	16	26	54	127	224	312	530	900	2935	491
70–74	83,973	4	16	25	50	129	232	333	506	891	2821	529
75–79	135,484	5	15	25	55	137	224	323	533	911	2278	433
80–84	203,181	6	15	25	55	131	227	311	527	902	2091	452
85–89	171,495	5	16	24	55	131	228	314	510	907	2049	437
90–94	102,330	6	16	25	54	131	220	325	532	884	1875	398
95–99	23,835	5	15	25	53	137	221	314	534	900	1777	322
>99	5,392	9	12	22	76	130		356	497	801	3243	293
Total	833,500	5	15	25	55	132	226	318	520	901	2255	452

TABLE B2—*Continued*

Entry Age	Number of Admissions	Length of Stay										
		1–10 Days	11–20 Days	21–30 Days	31–90 Days	91–180 Days	181–270 Days	271–365 Days	12–24 Months	25–36 Months	>36 Months	All Durations
		MALE AND FEMALE										
<45	36,351	4	16	26	61	144	234	330	469	863	3576	394
45–49	16,888	6	14	25	49	134	205	332	527	1022	1855	341
50–54	16,341	6	16	25	51	158	209	317	539	977	4476	656
55–59	28,823	6	15	25	65	139	255	318	507	892	2961	640
60–64	48,000	5	16	26	57	133	222	330	500	864	2589	418
65–69	77,433	5	16	26	55	125	223	316	518	913	2686	475
70–74	140,080	4	16	25	51	128	224	327	530	891	2553	441
75–79	220,119	5	15	25	55	133	222	321	522	902	2395	397
80–84	294,885	6	15	25	56	134	225	313	522	898	2086	401
85–89	236,315	5	16	24	56	131	226	316	508	912	2012	397
90–94	134,068	6	16	26	54	134	224	324	518	886	1836	363
95–99	41,782	5	15	25	50	136	225	321	541	906	1785	281
>99	7,303	7	17	24	72	121		351	497	801	3243	233
Total	1,299,196	5	16	25	55	133	225	319	516	900	2280	408

TABLE B3

INCIDENCE RATES AND PROBABILITIES OF LENGTH OF STAY
(BASED ON 1985 NATIONAL NURSING HOME SURVEY)

Entry Age	Incidence Rate	Probability of Length of Stay: All Durations	>10 Days	>20 Days	>30 Days	>90 Days	>180 Days	>270 Days	>365 Days	>24 Months	>36 Months
					MALE						
<45	.000321	1.000000	.816255	.725984	.697496	.455667	.336221	.293241	.207394	.058087	.037755
45–49	.002151	1.000000	.519444	.374692	.356568	.109561	.146320	.146320	.136599	.109330	.109326
50–54	.001899	1.000000	.732376	.668408	.603134	.368047	.361420	.301368	.235291	.137682	.079935
55–59	.003452	1.000000	.913074	.739276	.619465	.402070	.342138	.284616	.243055	.193888	.174388
60–64	.004815	1.000000	.931244	.829891	.822811	.572592	.381157	.248841	.242934	.126665	.074831
65–69	.007647	1.000000	.864946	.792398	.699335	.541612	.413153	.332585	.234816	.167472	.127862
70–74	.018018	1.000000	.844940	.797192	.653538	.448181	.313599	.233609	.202740	.115835	.090380
75–79	.040686	1.000000	.827696	.738372	.590301	.447287	.337876	.247701	.215599	.114164	.070325
80–84	.078467	1.000000	.843671	.747711	.647563	.409101	.299935	.228477	.200136	.117599	.072395
85–89	.120940	1.000000	.801713	.711016	.635099	.439743	.349324	.268948	.226446	.128375	.068713
90–94	.169005	1.000000	.832227	.700197	.637993	.481561	.335363	.272422	.213445	.090727	.064570
95–99	.286672	1.000000	.947556	.843594	.790532	.340930	.219976	.187305	.117869	.055538	.035374
>99	.130452	1.000000	.954998	.608583	.421247	.269494	.079018	.079018	.000002	.000002	
Total	.004089	1.000000	.833914	.739784	.644012	.440345	.327248	.252644	.210413	.117797	.078785
					FEMALE						
<45	.000124	1.000000	.819053	.786872	.742845	.617771	.477199	.412836	.344130	.207803	.124975
45–49	.000796	1.000000	.920422	.900844	.716423	.566318	.448634	.422529	.405477	.302530	.234736
50–54	.001133	1.000000	.872004	.802758	.789755	.488017	.334641	.252548	.252548	.171865	.171862
55–59	.001707	1.000000	.903566	.857566	.829592	.505715	.454593	.414109	.400812	.270001	.161544
60–64	.004158	1.000000	.930013	.841711	.747567	.471182	.355076	.299551	.270421	.165586	.123316
65–69	.010204	1.000000	.910961	.785464	.677403	.443315	.374378	.320104	.279097	.192513	.108400
70–74	.020786	1.000000	.894645	.778977	.706883	.497352	.374515	.315092	.277140	.185980	.135031
75–79	.042975	1.000000	.908551	.796907	.723740	.480435	.368555	.325842	.276088	.181361	.116486
80–84	.095041	1.000000	.869339	.758891	.694437	.493115	.391482	.316741	.275030	.198636	.146125
85–89	.140816	1.000000	.881869	.806841	.740991	.537120	.424178	.367553	.299820	.193724	.126254
90–94	.195326	1.000000	.851647	.758263	.700753	.522204	.426407	.349910	.303345	.180977	.116094
95–99	.208949	1.000000	.834091	.801492	.762096	.522700	.346803	.304979	.248347	.150654	.077891
>99	.138026	1.000000	.952708	.913576	.818065	.575669	.365729	.365729	.330307	.084573	.017062
Total	.006900	1.000000	.882221	.785949	.717609	.504249	.395025	.334649	.286466	.189040	.127052

TABLE B3—*Continued*

Entry Age	Incidence Rate	Probability of Length of Stay									
		All Durations	>10 Days	>20 Days	>30 Days	>90 Days	>180 Days	>270 Days	>365 Days	>24 Months	>36 Months
		MALE AND FEMALE									
<45	.000222	1.000000	.817034	.742951	.710133	.500841	.375508	.326569	.245499	.099809	.062061
45–49	.001455	1.000000	.632225	.522680	.457782	.296248	.231350	.224008	.212225	.163670	.144599
50–54	.001503	1.000000	.786917	.720887	.676031	.414909	.350960	.282299	.242033	.151035	.115843
55–59	.002538	1.000000	.909725	.780939	.693475	.438575	.381746	.330225	.298619	.220696	.169864
60–64	.004461	1.000000	.930625	.835834	.784980	.521605	.368043	.274335	.256752	.146232	.099208
65–69	.009028	1.000000	.893031	.788167	.685950	.481619	.389488	.324968	.261843	.182756	.115984
70–74	.019581	1.000000	.874736	.786273	.685517	.477658	.350117	.282456	.247341	.157885	.117147
75–79	.042065	1.000000	.877462	.774400	.672433	.467690	.356760	.295798	.252831	.155525	.098737
80–84	.089183	1.000000	.861357	.755415	.679861	.466989	.363013	.289293	.251740	.173435	.123197
85–89	.134742	1.000000	.859882	.780556	.711945	.510409	.403645	.340505	.279693	.175798	.110471
90–94	.188253	1.000000	.846962	.744255	.685613	.512400	.404443	.331216	.281657	.159204	.103664
95–99	.228113	1.000000	.869250	.814538	.770907	.466374	.307502	.268514	.207914	.121179	.064716
>99	.135960	1.000000	.953307	.833768	.714229	.495552	.290705	.290705	.243875	.062443	.012597
Total	.005536	1.000000	.864905	.769401	.691228	.481343	.370730	.305254	.259204	.163502	.109750

TABLE B4

DISTRIBUTION OF ADMISSIONS BY SEX AND BY LENGTH OF STAY FOR ALL AGES COMBINED
(BASED ON 1985 NATIONAL NURSING HOME SURVEY)

Length of Stay (Days)	Male		Female		Male and Female	
	No. of Admissions	No. of Days	No. of Admissions	No. of Days	No. of Admissions	No. of Days
1	8,705	8,705	14,635	14,635	23,340	23,340
2	5,782	11,564	10,377	20,754	16,159	32,318
3	7,914	23,742	10,022	30,066	17,936	53,808
4	6,224	24,896	11,239	44,956	17,463	69,852
5	6,575	32,875	6,917	34,585	13,492	67,460
6	13,025	78,150	11,327	67,962	24,352	146,112
7	8,083	56,581	9,419	65,933	17,502	122,514
8	11,321	90,568	7,953	63,624	19,274	154,192
9	4,859	43,731	7,197	64,773	12,056	108,504
10	4,858	48,580	9,083	90,830	13,941	139,410
11	3,128	34,408	9,697	106,667	12,825	141,075
12	3,414	40,968	4,923	59,076	8,337	100,044
13	4,091	53,183	7,459	96,967	11,550	150,150
14	8,090	113,260	12,165	170,310	20,255	283,570
15	2,950	44,250	8,709	130,635	11,659	174,885
16	4,283	68,528	6,735	107,760	11,018	176,288
17	3,807	64,719	6,203	105,451	10,010	170,170
18	2,753	49,554	8,752	157,536	11,505	207,090
19	5,264	100,016	8,995	170,905	14,259	270,921
20	6,056	121,120	6,605	132,100	12,661	253,220

TABLE B4—*Continued*

Length of Stay (Days)	Male		Female		Male and Female	
	No. of Admissions	No. of Days	No. of Admissions	No. of Days	No. of Admissions	No. of Days
21	3,007	63,147	7,501	157,521	10,508	220,668
22	7,425	163,350	8,272	181,984	15,697	345,334
23	6,476	148,948	7,034	161,782	13,510	310,730
24	1,395	33,480	6,818	163,632	8,213	197,112
25	4,857	121,425	3,554	88,850	8,411	210,275
26	5,253	136,578	6,082	158,132	11,335	294,710
27	2,913	78,651	4,215	113,805	7,128	192,456
28	5,491	153,748	5,194	145,432	10,685	299,180
29	3,637	105,473	4,186	121,394	7,823	226,867
30	4,147	124,410	4,106	123,180	8,253	247,590
31–90	94,847	5,290,787	177,836	9,717,686	272,683	15,008,473
91–180	52,669	7,006,343	91,039	12,062,222	143,708	19,068,565
181–270	34,743	7,733,401	50,324	11,391,981	85,067	19,125,382
271–365	19,667	6,325,182	40,161	12,788,722	59,828	19,113,904
366–730	43,131	21,965,285	81,205	42,241,993	124,336	64,207,278
731–1095	18,166	16,314,900	51,663	46,550,500	69,829	62,865,400
>1095	36,690	86,218,152	105,898	238,828,239	142,588	325,046,391
All Durations	465,696	153,092,658	833,500	376,732,580	1,299,196	529,825,238

TABLE B5

DISTRIBUTION OF ADMISSIONS BY SEX AND BY LENGTH OF STAY FOR ALL AGES COMBINED
(BASED ON 1985 NATIONAL NURSING HOME SURVEY)

Threshold (Days)	Male		Female		Male and Female	
	No. of Admissions with LOS over Threshold	No. of Days over Threshold	No. of Admissions with LOS over Threshold	No. of Days over Threshold	No. of Admissions with LOS over Threshold	No. of Days over Threshold
0	465,696 (1.000)	153,092,658 (1.000)	833,500 (1.000)	376,732,580 (1.000)	1,299,196 (1.000)	529,825,238 (1.000)
1	456,991 (0.981)	152,626,962 (0.997)	818,865 (0.982)	375,899,080 (0.998)	1,275,856 (0.982)	528,526,042 (0.998)
2	451,209 (0.969)	152,169,971 (0.994)	808,488 (0.970)	375,080,215 (0.996)	1,259,697 (0.970)	527,250,186 (0.995)
3	443,295 (0.952)	151,718,762 (0.991)	798,466 (0.958)	374,271,727 (0.993)	1,241,761 (0.956)	525,990,489 (0.993)
4	437,071 (0.939)	151,275,467 (0.988)	787,227 (0.944)	373,473,261 (0.991)	1,224,298 (0.942)	524,748,728 (0.990)
5	430,496 (0.924)	150,838,396 (0.985)	780,310 (0.936)	372,686,034 (0.989)	1,210,806 (0.932)	523,524,430 (0.988)
6	417,471 (0.896)	150,407,900 (0.982)	768,983 (0.923)	371,905,724 (0.987)	1,186,454 (0.913)	522,313,624 (0.986)
7	409,388 (0.879)	149,990,429 (0.980)	759,564 (0.911)	371,136,741 (0.985)	1,168,952 (0.900)	521,127,170 (0.984)
8	398,067 (0.855)	149,581,041 (0.977)	751,611 (0.902)	370,377,177 (0.983)	1,149,678 (0.885)	519,958,218 (0.981)
9	393,208 (0.844)	149,182,974 (0.974)	744,414 (0.893)	369,625,566 (0.981)	1,137,622 (0.876)	518,808,540 (0.979)
10	388,350 (0.834)	148,789,766 (0.972)	735,331 (0.882)	368,881,152 (0.979)	1,123,681 (0.865)	517,670,918 (0.977)
11	385,222 (0.827)	148,401,416 (0.969)	725,634 (0.871)	368,145,821 (0.977)	1,110,856 (0.855)	516,547,237 (0.975)
12	381,808 (0.820)	148,016,194 (0.967)	720,711 (0.865)	367,420,187 (0.975)	1,102,519 (0.849)	515,436,381 (0.973)
13	377,717 (0.811)	147,634,386 (0.964)	713,252 (0.856)	366,699,476 (0.973)	1,090,969 (0.840)	514,333,862 (0.971)
14	369,627 (0.794)	147,256,669 (0.962)	701,087 (0.841)	365,986,224 (0.971)	1,070,714 (0.824)	513,242,893 (0.969)
15	366,677 (0.787)	146,887,042 (0.959)	692,378 (0.831)	365,285,137 (0.970)	1,059,055 (0.815)	512,172,179 (0.967)
16	362,394 (0.778)	146,520,365 (0.957)	685,643 (0.823)	364,592,759 (0.968)	1,048,037 (0.807)	511,113,124 (0.965)
17	358,587 (0.770)	146,157,971 (0.955)	679,440 (0.815)	363,907,116 (0.966)	1,038,027 (0.799)	510,065,087 (0.963)
18	355,834 (0.764)	145,799,384 (0.952)	670,688 (0.805)	363,227,676 (0.964)	1,026,522 (0.790)	509,027,060 (0.961)
19	350,570 (0.753)	145,443,550 (0.950)	661,693 (0.794)	362,556,988 (0.962)	1,012,263 (0.779)	508,000,538 (0.959)
20	344,514 (0.740)	145,092,980 (0.948)	655,088 (0.786)	361,895,295 (0.961)	999,602 (0.769)	506,988,275 (0.957)

TABLE B5—*Continued*

Threshold (Days)	Male		Female		Male and Female	
	No. of Admissions with LOS over Threshold	No. of Days over Threshold	No. of Admissions with LOS over Threshold	No. of Days over Threshold	No. of Admissions with LOS over Threshold	No. of Days over Threshold
21	341,507 (0.733)	144,748,466 (0.945)	647,587 (0.777)	361,240,207 (0.959)	989,094 (0.761)	505,988,673 (0.955)
22	334,082 (0.717)	144,406,959 (0.943)	639,315 (0.767)	360,592,620 (0.957)	973,397 (0.749)	504,999,579 (0.953)
23	327,606 (0.703)	144,072,877 (0.941)	632,281 (0.759)	359,953,305 (0.955)	959,887 (0.739)	504,026,182 (0.951)
24	326,211 (0.700)	143,745,271 (0.939)	625,463 (0.750)	359,321,024 (0.954)	951,674 (0.733)	503,066,295 (0.949)
25	321,354 (0.690)	143,419,060 (0.937)	621,909 (0.746)	358,695,561 (0.952)	943,263 (0.726)	502,114,621 (0.948)
26	316,101 (0.679)	143,097,706 (0.935)	615,827 (0.739)	358,073,652 (0.950)	931,928 (0.717)	501,171,358 (0.946)
27	313,188 (0.673)	142,781,605 (0.933)	611,612 (0.734)	357,457,825 (0.949)	924,800 (0.712)	500,239,430 (0.944)
28	307,697 (0.661)	142,468,417 (0.931)	606,418 (0.728)	356,846,213 (0.947)	914,115 (0.704)	499,314,630 (0.942)
29	304,060 (0.653)	142,160,720 (0.929)	602,232 (0.723)	356,239,795 (0.946)	906,292 (0.698)	498,400,515 (0.941)
30	299,913 (0.644)	141,856,660 (0.927)	598,126 (0.718)	355,637,563 (0.944)	898,039 (0.691)	497,494,223 (0.939)
90	205,066 (0.440)	127,107,323 (0.830)	420,290 (0.504)	326,037,557 (0.865)	625,356 (0.481)	453,144,880 (0.855)
180	152,397 (0.327)	111,125,460 (0.726)	329,251 (0.395)	292,536,255 (0.777)	481,648 (0.371)	403,661,715 (0.762)
270	117,654 (0.253)	99,056,939 (0.647)	278,927 (0.335)	265,099,164 (0.704)	396,581 (0.305)	364,156,103 (0.687)
365	97,987 (0.210)	88,733,082 (0.580)	238,766 (0.286)	240,471,142 (0.638)	336,753 (0.259)	329,204,224 (0.621)
730	54,856 (0.118)	62,488,172 (0.408)	157,561 (0.189)	170,359,209 (0.452)	212,417 (0.163)	232,847,381 (0.439)
1095	36,690 (0.079)	46,042,602 (0.301)	105,898 (0.127)	122,869,929 (0.326)	142,588 (0.110)	168,912,531 (0.319)