2000 Life Table Estimates for the Philippines and Provinces By Sex

Josefina V. Cabigon

PHDR TECHNICAL ISSUE/ NOTE

PHDR ISSUE: 2008/2009 NO. 3

For comments, suggestions and further inquiries, please contact:
Room 334, School of Economics, University of the Philippines, Diliman, Quezon City
+632-927-8009 +632-927-9686 loc.334 http://www.hdn.org.ph

2000 Life Table Estimates for the Philippines and Provinces By Sex

Josefina V. Cabigon, Ph.D.
Population Institute
Collage of Social Sciences and Philosophy
University of the Philippines
Diliman, Quezon City

April 2009

I. Technical Notes: 2000 National, and Provincial Life Tables with the National Capital Region Considered as a province in the 2000 human development index estimation

A. Definitions and Uses

Life Tables are the best analytical tool for mortality analysis and source of mortality indicators which epidemiologists, researchers and planners demand. As Coale and Demeny (1966:5) point out 'Life tables provide a succinct description of what is the most prominent aspect of the state of human mortality; they show the varying chances of dying as a function of age.' Life tables are either complete (life-table functions for single years of age) or abridged (life-table functions for groups of ages as the more common)

Life tables can be interpreted as the mortality experience of a cohort (real or hypothethical) or tracing a cohort of newborn babies through their entire life or as a stationary population (Shryock, Siegel and Associates, 1975:431-433) . In reality, the first interpretation refers to a hypothetical cohort of newborn babies, usually 100,000 and being followed through their entire life assuming that they are subject to the current observed age-specific death rates and the population is stationary. A stationary population is a closed population (zero migration) in which the number of births and the number of deaths each year are equal and therefore the population is neither growing nor declining in size (constant age structure).

Life tables are very useful tool to reconstruct mortality trends, to examine areal or provincial patterns of mortality or to analyze adult mortality. Because of the substantial differentials in mortality by gender, life tables are generally generated separately for males and females.

B. Data Sources and Methodology of Correcting Under-registration of Deaths

The main data sources in the generation of the 2000 national and provincial life tables are the 2000 registered deaths by gender and age groups published annually by the National Statistics Office and the 2000Census of Population and Housing.

Given the inherent under-registration of deaths in the Philippines, it was important to estimate the completeness of death registration using the following four techniques: (1) Brass's sectional growth balance method (1975); (2) Courbage and Fargues's method (1979); (3) Preston and Coale's method (1980); and (4) Gray's method (1986). These methods were used in the generation of life tables for 1960, 1970, 1975, and 1980 (Cabigon, 1990), for 1970, 1980 and 1990 by Flieger and Cabigon (1994), and for 1995 by Cabigon and Flieger (1999). These studies have shown consistently that the four techniques of estimating the level of completeness of death registration produce closely or moderately consistent estimates, depending on their similarity in assumptions and robustness to violations of their assumptions.. The great variation by province as to economic standing, changes in the demographic processes – fertility, mortality and migration – reflects the choice of the best possible estimates of completeness of death registration being based not only on one technique for all provinces, but on different techniques in accordance with the strengths or robustness of a given technique on a given province. The Courbage and Fargues technique is most robust to provinces experiencing substantial in- or out-migration, the Gray and Preston and Coale techniques provide the best in provinces experiencing population non-stability while the Brass technique yielded the best in a few provinces experiencing some population stability. The chosen estimates were used to correct the registered deaths by age for ages 5 and over. For the deaths aged less than five years, the adjusted age-specific death rate or ${}_nm_x$ in life table terminology, at ages 5-9 for a given province was used to obtain the central death rates for ages 0 and 1 to 4 years of the United Nations (UN) Latin American pattern (UN, 1982) for that province.

The ${}_nm_x$ values were the input in the generation of the life tables. They were derived based on the formula (${}_nD_x$/ ${}_nP_x$) where ${}_nD_x$ refers to the deaths adjusted for under-registration to persons in the age interval (x,x+n) and ${}_nP_x$ refers to the midyear number of persons in the age interval (x,x+n). Because of the erratic resulting ${}_nm_x$ values after applying the adjustment factors, smoothing using the Gompertz curve or moving averages was done in to conform with the expected pattern of the death function.

C. Generation of the 2000 National and Provincial Life Tables

The 2000 national and regional life tables were generated using the life table (LIFTB) procedure of the United Nations (2003) MORTPAK for Windows (Version 4). LIFTB procedure is based on a method developed by Greville (1943) and it uses the Makeham-type curve to extrapolate the ${}_nq_x$ values (as defined below) until there are no survivors remaining (United Nations, 1982:31). LIFTB (United Nations, 2003, LIFTB description) yields the output in the usual life table columns calculated, labeled and defined as follows:

Age: the initial age of the age interval (x,x+n) where x is the initial age and n is the length of the interval. The interval length is five years, with the exception of infancy (one year), early childhood years (four-year age group) and last open ended interval (95+);

m(x,n): central death rate for the age interval (x,x+n). It is the age-specific death rate in usual life table notation as ${}_nm_x$ (see notes on its derivation below);

q(x,n): probability of an individual age x dying before the end of the age interval (x,x+n). Usual notation is ${}_nq_x$;

l(x): number of survivors at age x in a life table with radix (starting population) of 100,000 persons. Usual notation is l_x ;

d(x,n): number of deaths in age interval (x,x+n). Usual notation is ${}_nd_x$;

L(x,x+n): number of person-years lived in age interval (x,x+n). Usual notation is ${}_nL_x$;

S(x,x+n): the proportion of the life table population in age group (x,x+n) who are alive n year later. Usual notation is ${}_nS_x$;

T(x): number of person-years lived at ages x and older. Usual notation is T_x;

e(x): expectation of life at age x. Usual notation is e_x;

a(x,n): average number of years lived in the age interval (x,x+n) by those dying during that age interval. Usual notation is ${}_na_x$.

D. Applications of Life Tables

Applications of life tables are grouped into the following three main areas: (1) mortality analysis; (2) analysis of fertility, reproductivity and age structure; and (3) analysis of socioeconomic structure and dynamics. Under each main area are several sub-areas in which life tables are specifically applied. Each of these main areas and its sub-areas are presented here sequentially.

D. 1. Mortality Analysis

D.1.1 Measurement of the Level of Mortality, Survivorship and Life Expectancy

Life table is the best source of mortality level indicators. The expectation of life at birth (e_0) is the most refined and common indicator of the level of mortality of a given population. For example, a Filipino male born in 2000 would expect to live here on earth 65 years, on the average. A Filipino female aged 65 in 2000 would expect to live around 16.4 years more years on the average.

The life expectancy at birth is also the most common measure used to compare the mortality level of the provinces.

The infant mortality rate or q_0 is also a mortality level indicator but in practice it is used more as an indicator of the socioeconomic condition of a country or a province given that it is does not represent a summarization of the whole series of mortality rates for all ages combined which the life expectation of life at birth does.

D.1.2 Analysis of Mortality by Cause of Death

One of the main reasons of complete life tables is the need for general population life tables by age, sex and calendar time in the estimation of cancer patient survival.

D.1.3 Applications in Measurement of Morbidity and Health

Nowadays, it has been realized by demographers as spearheaded by organization known as the Network on Health Expectancy or REVES (Reseau Esperance de Vie en Sante) under the coordination of Dr. Jean Marie Robine (Euro-REVES, 1997) that the life expectancy from the general population life tables is limited as a measure of a population's health status because it does not provide an estimate of how healthy the population is when it is alive. The life expectancy from the general population has to be partitioned into healthy and non-healthy years of life. The general population life tables are required for the estimation of a population's health expectancy.

D. 2. Analysis of Age Structure, Fertility and Reproductivity

D. 2. 1 Survival Ratios: Age Structure Generation and Analysis

The life table has been the most common source for making population projections or for making estimates of the population by age between census years or two periods. Life table survival ratios are of two types. One refers to the survival ratios (SRs) or the proportion of the population x years of age which will survive x years and which are derived from the L_x values of the life table using the following formula:

$$_nSR_x = {_5L_{x+5}}/{_5L_x} \qquad (1)$$

For example, the survival ratio for ages 5-9, female Philippines, 2000 is : $_5SR_5 = {_5L_{10}}/{_5L_5}$ and by substitution, $_5SR_5$ = 466708/468778=0.99558 or the proportion of persons 5 -9 years of age which will survive five years. This can be applied to forward survive the 4,732,768 enumerated female population aged 5-9 years in 2000 who would survive the following 5 years, that is in 2005 or 0.99558 * 4,732,768 = 4,714,836 or to reverse survive the same number which would have had survived five years before, that is in 1995 or 4,732,768/0.99558 = 4,753,780.

The other type of survival ratio (sr) or the proportion of the population surviving from age x to age x+1 and which are obtained from the l_x values using the following formula:

$$ {}_5sr_x = l_{x+5}/l_x \qquad (2) $$

For example, the survival ratio for the same age 5, female Philippines, 2000 is ${}_5sr_5=l_{10}/l_5$ and by substitution, ${}_5sr_5$ = 93,542/93,969= 0.99546 or the proportion of female aged 5 expected to live to age 10. This can also be stated as 'out of the 93,969 Filipino males alive at age 5 (l_5), 93,542 are expected to be alive at age 10. To apply this ${}_5sr_5$, we need the enumerated female population exactly age 5 in 2000 to get the expected survivors to exactly age10. In most cases, we do not have the published enumerated female population in single ages, what we commonly have is the 4,732768 enumerated female population aged 5 to 9; hence, the SR_s based on the L_x values are actually used in population projections or estimations.

Correspondingly, survival from birth to a given age interval is in the form of ${}_5L_x/5l_0$. For example, the survival rate from birth to age 40-44 is ${}_5L_{40}/5l_0$. Thus, by substituting the values for female Philippines, we have 446,167/5* 100,000 or .89233.,

On the other hand, survival from birth to their x birthday is in the form of l_x/l_0. For example, the proportion of the newborn female Filipino infants who will reach age 40 is l_{40}/ l_0 or 89,874/100,000=.89874.

D. 2. 1 Survival Ratios: Fertility and Reproductivity Analysis

To arrive at a measure of how many daughters would replace 1000 women if age-specific fertility and mortality rates remained constant indefinitely or the net reproduction rate (NRR), we need two sets of indicators. These are the age-specific fertility rates (per 1000 women) considering only female births in the estimation in five-year age intervals from age 15 to 49 (reproductive ages) and the number of person-years lived per woman in the age interval, x referring to the exact age at the beginning of the age interval (${}_nL_x/l_0$) which originates from an appropriate abridged female life table . Simply summing the products of these two indicators per age interval yields NRR.

D.3. Analysis of Socioeconomic Structure and Dynamics

In the analysis of socioeconomic structure and dynamics, life tables are interpreted as stationary populations and multiple decrement tables incorporating conventional life table components and using life table techniques are constructed. For example in the planning of manpower, we construct working life tables under the assumption of a constant intake of new employees each year and a corresponding constant loss of employees each year from all causes including death, resignation, dismissal and retirement and therefore the size of the manpower remains the same. Working life tables provide the average entry into the labor force or exit from the non-working population, the average remaining years of active life in the labor force and the separation rates from all causes, death and retirement. First-marriage tables are other examples of multiple decrement tables which yield the proportion of the population who ever marry, the average age at marriage and the average years of single life.

References

Indirect Estimation of completeness of death registration arranged chronologically

Brass's sectional growth balance method (1975) - Brass, William (1975). *Methods for Estimating Fertility and Mortality from Limited and Defective Data,* Laboratories for Population statistics (POPLAB), North Carolina.

Courbage and Fargues's method (1979) – Courbage, Y. and P. Fargues (1979). "A Method for Deriving Mortality Estimates from Incomplete Vital Statistics', *Population Studies,* 33(1):65-80.

Preston and Coale's method (1980) – Preston, Samuel H., A. J. Coale, T. J. Trusell and M. Weinstein (1980), "Estimating the Completeness of Reporting of adult Deaths in Populations that are approximately Stable", *Population Index,* 46(2): 179-202.

Gray's method (1986)- Gray, Alan (1986). "Sectional Growth Balance analysis for Non-Stable Closed Populations', *Population Studies,* 40(3): 4259-436.

Life Table Generation

Greville, T.N.E. (1943). "Short Methods of Constructing Abridged Life Tables", *The Record of the American Institute of Actuaries.* Col. XXXII, Part 1, No. 65 (June).

United Nations (1982)). *Model Life Tables for Developing Countries.* United Nations Publication, Sales No. E.81.X111.7.

United Nations (2003). *Mortpak for Windows Version 4.0.* New York: United Nations.

Other Main References

Cabigon, Josefina V. (1990). 'Philippine Mortality in Changing Times', Unpublished Ph.D. Dissertation, Australian National University.

Cabigon, Josefina V. and Flieger, Wilhelm (1999). *1995 Gender-Specific Life Tables for the Philippines, Its Regions and Provinces.* Monograph No. 17.Manila: National Statistics Office, with the assistance of the United nations Population fund.

Coale, Ansley J. and Demeny, Paul (1966) . *Regional Model Life Tables and Stable Populations.* Princeton: Princeton University Press.

Euro-REVES (1997). Health Expectancy Calculation by the Sullivan Method: A Practical Guide. (by Jagger C). Euro-REVES, Montpellier.

Flieger, Wilhelm and Cabigon, Josefina V. (1994). *Life Tables Estimates, For the Philippines, Its Regions, and provinces by Sex: 1970, 1980 and 1990.* Health Finance Development Monograph No. %. Manila: Department of health, Republic of the Philippines, under the health Finance Development Project, with the assistance of the United Agency for International Development.

National Statistics Office (2003) *2000 Census of Population and Housing.* Manila: National Statistics Office.

National Statistics Office (2003) *2000 Vital Statistics Report.* Manila: National Statistics Office.

Shryock, Henry S., Siegel, Jacob S. and Associates. (1975). *The Methods and Materials of Demography.* Washington D.C. : Government Printing Office.

Female Life Table, National Capital Region, 2000

AGE	M(X,N)	Q(X,N)	I(X)	D(X,N)	L(X,N)	S(X,N)		T(X)	E(X)	A(X,N)
0	.03318	.03227	100000.	3227.	97247.	.96355	/A/	7208477.	72.085	0.147
1	.00264	.01049	96773.	1015.	384527.	.99247	/B/	7111230.	73.483	1.472
5	.00054	.00270	95758.	258.	478145.	.99750		6726703.	70.247	2.500
10	.00046	.00230	95500.	219.	476951.	.99751		6248558.	65.430	2.500
15	.00056	.00280	95281.	266.	475763.	.99678		5771606.	60.575	2.598
20	.00074	.00369	95014.	351.	474229.	.99590		5295843.	55.737	2.602
25	.00092	.00459	94663.	435.	472287.	.99429		4821614.	50.934	2.631
30	.00140	.00698	94229.	657.	469592.	.99201		4349327.	46.157	2.639
35	.00182	.00906	93571.	848.	465841.	.98928		3879735.	41.463	2.623
40	.00257	.01277	92723.	1184.	460846.	.98390		3413894.	36.818	2.660
45	.00403	.01996	91539.	1827.	453427.	.97584		2953048.	32.260	2.664
50	.00588	.02900	89712.	2602.	442470.	.96360		2499621.	27.863	2.660
55	.00920	.04503	87110.	3923.	426366.	.94515		2057151.	23.616	2.659
60	.01380	.06685	83188.	5561.	402980.	.91212		1630785.	19.604	2.670
65	.02389	.11312	77626.	8781.	367568.	.86002		1227805.	15.817	2.658
70	.03744	.17191	68845.	11835.	316115.	.78238		860237.	12.495	2.625
75	.06326	.27444	57010.	15646.	247323.	.65559		544121.	9.544	2.589
80	.10789	.42292	41364.	17494.	162143.	.53231		296799.	7.175	2.446
85	.14364	.51937	23871.	12398.	86310.	.42408		134655.	5.641	2.335
90	.20529	.65494	11473.	7514.	36603.	.24289	/C/	48345.	4.214	2.237
95	.33713	.....	3959.	3959.	11743.	.....		11743.	2.966	2.966

/A/ VALUE GIVEN IS FOR SURVIVORSHIP OF 5 COHORTS OF BIRTH TO AGE GROUP 0-4 = L(0,5)/500000
/B/ VALUE GIVEN IS FOR S(0,5)=L(5,5)/L(0,5)
/C/ VALUE GIVEN IS S(90+,5)=T(95)/T(90)

Male Life Table, National Capital Region, 2000

AGE	M(X,N)	Q(X,N)	I(X)	D(X,N)	L(X,N)	S(X,N)		T(X)	E(X)	A(X,N)
0	.03674	.03562	100000.	3562.	96954.	.96052	/A/	6755743.	67.557	0.145
1	.00260	.01033	96438.	997.	383306.	.99203	/B/	6658789.	69.047	1.546
5	.00065	.00324	95441.	310.	476432.	.99705		6275483.	65.752	2.500
10	.00053	.00265	95132.	252.	475029.	.99661		5799051.	60.958	2.500
15	.00091	.00454	94880.	431.	473416.	.99401		5324022.	56.113	2.718
20	.00152	.00757	94449.	715.	470580.	.99094		4850606.	51.357	2.672
25	.00211	.01050	93734.	984.	466317.	.98824		4380026.	46.728	2.610
30	.00263	.01307	92750.	1212.	460832.	.98519		3913709.	42.196	2.593
35	.00339	.01681	91538.	1539.	454008.	.98054		3452876.	37.721	2.608
40	.00457	.02261	89999.	2034.	445172.	.97282		2998868.	33.321	2.630
45	.00662	.03259	87964.	2867.	433074.	.96029		2553696.	29.031	2.646
50	.00986	.04819	85097.	4101.	415876.	.93961		2120622.	24.920	2.656
55	.01546	.07459	80997.	6041.	390761.	.90893		1704746.	21.047	2.646
60	.02315	.10969	74956.	8222.	355173.	.86846		1313986.	17.530	2.616
65	.03393	.15683	66733.	10466.	308455.	.81217		958813.	14.368	2.591
70	.05030	.22395	56268.	12601.	250516.	.73758		650358.	11.558	2.554
75	.07272	.30771	43667.	13437.	184775.	.64393		399842.	9.157	2.503
80	.10537	.41473	30230.	12537.	118983.	.52896		215067.	7.114	2.434
85	.15223	.54153	17693.	9581.	62938.	.39831		96084.	5.431	2.336
90	.21963	.67876	8112.	5506.	25069.	.24370	/C/	33146.	4.086	2.187
95	.32259	.....	2606.	2606.	8078.	.....		8078.	3.100	3.100

/A/ VALUE GIVEN IS FOR SURVIVORSHIP OF 5 COHORTS OF BIRTH TO AGE GROUP 0-4 = L(0,5)/500000
/B/ VALUE GIVEN IS FOR S(0,5)=L(5,5)/L(0,5)
/C/ VALUE GIVEN IS S(90+,5)=T(95)/T(90)

Male Life Table, Philippines, 2000

AGE	M(X,N)	Q(X,N)	I(X)	D(X,N)	L(X,N)	S(X,N)	T(X)	E(X)	A(X,N)
0	.05196	.04985	100000.	4985.	95941.	.94372 /A/	6505221.	65.052	0.186
1	.00441	.01745	95015.	1658.	375920.	.98660 /B/	6409280.	67.456	1.503
5	.00107	.00534	93357.	498.	465540.	.99514	6033361.	64.627	2.500
10	.00088	.00439	92859.	408.	463276.	.99473	5567820.	59.960	2.500
15	.00132	.00658	92451.	608.	460836.	.99187	5104545.	55.213	2.665
20	.00197	.00980	91843.	900.	457090.	.98855	4643709.	50.561	2.640
25	.00264	.01312	90943.	1193.	451856.	.98517	4186619.	46.036	2.606
30	.00336	.01667	89750.	1496.	445155.	.98107	3734762.	41.613	2.598
35	.00436	.02158	88254.	1904.	436726.	.97461	3289608.	37.274	2.614
40	.00607	.02992	86350.	2584.	425639.	.96345	2852881.	33.039	2.635
45	.00887	.04342	83766.	3637.	410084.	.95297	2427242.	28.976	2.595
50	.01048	.05111	80129.	4096.	390798.	.93801	2017158.	25.174	2.596
55	.01563	.07536	76033.	5730.	366572.	.90971	1626360.	21.390	2.627
60	.02259	.10715	70304.	7533.	333475.	.87278	1259788.	17.919	2.605
65	.03241	.15028	62770.	9433.	291051.	.82283	926313.	14.757	2.583
70	.04650	.20878	53337.	11136.	239485.	.75405	635261.	11.910	2.557
75	.06793	.29068	42201.	12267.	180583.	.65965	395776.	9.378	2.520
80	.10090	.40153	29934.	12019.	119122.	.53551	215193.	7.189	2.458
85	.15254	.54316	17915.	9731.	63791.	.39221	96071.	5.363	2.350
90	.22611	.69124	8184.	5657.	25020.	.22491 /C/	32280.	3.944	2.189
95	.34807	.....	2527.	2527.	7260.	.....	7260.	2.873	2.873

/A/ VALUE GIVEN IS FOR SURVIVORSHIP OF 5 COHORTS OF BIRTH TO AGE GROUP 0-4 = L(0,5)/500000
/B/ VALUE GIVEN IS FOR S(0,5)=L(5,5)/L(0,5)
/C/ VALUE GIVEN IS S(90+,5)=T(95)/T(90)

Female Life Table, Philippines, 2000

AGE	M(X,N)	Q(X,N)	I(X)	D(X,N)	L(X,N)	S(X,N)	T(X)	E(X)	A(X,N)
0	.04500	.04340	100000.	4340.	96442.	.94955 /A/	7033279.	70.333	0.180
1	.00447	.01768	95660.	1691.	378334.	.98737 /B/	6936837.	72.515	1.453
5	.00091	.00454	93969.	427.	468778.	.99558	6558503.	69.794	2.500
10	.00086	.00429	93542.	401.	466708.	.99590	6089725.	65.101	2.500
15	.00079	.00394	93141.	367.	464797.	.99564	5623016.	60.371	2.528
20	.00099	.00494	92774.	458.	462772.	.99428	5158219.	55.600	2.606
25	.00133	.00663	92316.	612.	460124.	.99221	4695447.	50.863	2.623
30	.00181	.00901	91704.	826.	456538.	.99002	4235323.	46.185	2.603
35	.00222	.01104	90877.	1003.	451982.	.98714	3778785.	41.581	2.603
40	.00304	.01509	89874.	1356.	446167.	.98170	3326803.	37.016	2.639
45	.00446	.02207	88518.	1953.	438002.	.97303	2880636.	32.543	2.652
50	.00660	.03249	86564.	2813.	426187.	.96128	2442634.	28.218	2.642
55	.00940	.04598	83751.	3851.	409683.	.94286	2016447.	24.077	2.644
60	.01447	.06995	79900.	5589.	386272.	.91741	1606764.	20.110	2.633
65	.02059	.09819	74311.	7296.	354368.	.87240	1220492.	16.424	2.645
70	.03559	.16418	67014.	11003.	309149.	.79375	866123.	12.924	2.644
75	.05865	.25695	56012.	14392.	245388.	.67837	556974.	9.944	2.591
80	.09898	.39588	41620.	16477.	166464.	.55287	311586.	7.486	2.473
85	.13866	.50754	25143.	12761.	92032.	.43148	145122.	5.772	2.360
90	.20265	.64991	12382.	8047.	39710.	.25203 /C/	53090.	4.288	2.241
95	.32397	.....	4335.	4335.	13381.	.....	13381.	3.087	3.087

/A/ VALUE GIVEN IS FOR SURVIVORSHIP OF 5 COHORTS OF BIRTH TO AGE GROUP 0-4 = L(0,5)/500000
/B/ VALUE GIVEN IS FOR S(0,5)=L(5,5)/L(0,5)
/C/ VALUE GIVEN IS S(90+,5)=T(95)/T(90)