The Life Table without the Civil Registration System: Alternative Models of Indonesian Mortality

Mira M. Hidajat, Mark D. Hayward, and Latrica E. Best
The Pennsylvania State University

ABSTRACT

Without a reliable vital events registration system, Indonesia mainly relied on model life tables to estimate its mortality schedule. However, Model West life tables are not based on Indonesia's own demographic experience. In this paper, we develop three models of Indonesia's mortality schedules, namely using Model West life table, using indirect estimation of mortality from the National Social and Economic Survey (SUSENAS), a nationally representative cross-sectional survey, and using hazard modeling for longitudinally observed mortality from the Indonesian Family Life Survey (IFLS). We evaluate the implications and assumptions of using model life tables and survey data in the resulting life table estimations. We find general similarities in the life table estimates of all three models with some discrepancies by age and sex. We conclude that while there is no gold standard for Indonesian mortality, observed mortality from the IFLS provides a stronger base for estimation of Indonesian mortality.

EXTENDED ABSTRACT

Introduction

For many developing countries, demographers have created national life tables based on model life tables because of vital statistics data unavailability and poor quality. The collection of complete and high quality vital statistics data require a lot of resources which may not be available in developing nations. Indonesia's vital statistics system suffers from these issues. Vital events are collected at the village level. In rural areas particularly, registration of vital events for adults is poor because it is not mandated by law and is not culturally normative (Muhidin 2002).[1] Furthermore, as an archipelago, development has been unequal among the main islands in Indonesia and has been concentrated mainly in Java. Thus, the quality of the vital events registration system varies greatly from one island to the next.

As a consequence of the incompleteness of vital statistics data, Indonesia's mortality schedules often rely on the Model West life table, with some adjustments in level. The appropriateness of using the Model West to approximate Indonesia's mortality schedule has been questioned. From comparing age distributions of two decennial censuses, some studies found that Indonesia's survival pattern is different than the Model West (Heligman 1975; Sinquefield and Kartoyo 1977; McDonald 1978; Gardiner 1978; Agung et al., 1997; Muhidin 2002). Other studies using indirect measures of mortality found the opposite, that the Model West approximates Indonesia's mortality patterns (Agung et al. 1997).

Previous studies, however, did not evaluate the quality of census or survey data used to create their life tables. Methodological tools such as the General Growth Balance technique (Hill 1987) make it possible to assess the completeness of these mortality data and adjust them prior to creating the life table. Furthermore, previous studies have had to rely on indirect measures of mortality, i. e. mortality information from secondary informants. More recently, however, it is possible to analyze longitudinally *observed* mortality using the Indonesian Family Life Survey (IFLS). In this paper, we evaluate the strengths and weaknesses of the underlying assumptions of three models of Indonesia's mortality schedules, namely the Model West life table, the General Growth Balance technique for indirect estimation of mortality, and hazard modeling for longitudinally observed mortality from the IFLS. We also discuss the implications of using survey data as opposed to vital registration data to create standard life tables. We also compare the implications of these data, methods and their assumptions on the resulting life table estimates.

Data

Indonesian Family Life Survey (IFLS)

The main source of data for this study comes from two waves of the Indonesian Family Life Survey (IFLS), 1993 and 1997. This survey is representative of 83 percent of the Indonesian

[1] Children's vital events registration, on the other hand, has received national priority and was made compulsory. Nevertheless, the Indonesian Demographic and Health Survey (IDHS) 2002-2003 found only 46.5 percent of births that occurred since 1997 were registered (BPS and ORC Macro 2004). Birth registration records accepted for the IDHS interview include one or more of the following: hospital record, village record, proof of birth issued by the regency or municipality office, or birth certificate. Reasons for not registering births include: "Costs too much" (28%), "Did not know where to register" (10%), "Did not know child has to be registered" (13%), "Too far" (10%), "Late, did not want to pay fine" (3%), and "Other" (37%).

population. 7,224 households surveyed, with a 93% response rate in 1993 and 91% in 1997. The analysis uses the entire dataset of persons over 5 years, with a total sample of 33,081. The follow-up wave identifies whether respondents had died over the study interval.

National Social and Economic Survey (SUSENAS)

SUSENAS is an annual survey of social and economic indicators conducted by the Indonesian government since the 1960s. Since the 1980s, the survey has been conducted annually in January. The survey is nationally representative and sampled 206,240 households each year in the 1990s. The data used for this study are death and population counts by sex and 5-year age groups from 1996 and 1998.[2] Population and death counts for 1997 are calculated as an average of 1996 and 1998. SUSENAS mortality data are obtained from the question: "Did anyone in this household die within the last 12 months?" Information on decedents' age and sex were then obtained.

Since mortality information was collected in an indirect manner from a secondary source, we used the General Growth Balance technique for estimating mortality from incomplete data (Hill 1987) to adjust the data. This technique extends the Brass Growth Balance technique by incorporating two or more censuses/surveys to generate more precise mortality estimates. This technique also simultaneously estimates the incompleteness of the mortality data in the survey. We found that the data were 64.7 percent complete for men and 51.6 percent complete for women.

United Nations Estimates

We also obtained l_x values from the UN in 5-year age groups for both sexes combined for the 1990-1995 and 1995-2000 periods.[3] The UN does not publish official life tables but creates life tables to compute key demographic indicators for member countries. These data were based on Model West model life tables.

Analysis Plan

We first elaborate on assumptions underlying each method prior to constructing the life table. We also discuss the application of the General Growth Balance technique to estimate the completeness of the SUSENAS mortality data and subsequently to correct undercounts. We also elaborate on using hazard modeling to estimate mortality rates for the IFLS. IFLS life tables are based on a statistical model of mortality risk in which the log of the risk of death is regressed on age and sex. The parameter estimates of the hazard model are then used to calculate predicted mortality rates, and the age schedules are the input for the life table calculations.

Our central approach then is to calculate life tables from these data sources that depict Indonesian mortality in the 1990s: IFLS, National and Social Economic Survey (SUSENAS), and United Nations (UN). UN life tables are calculated from l_x values used by the UN to create demographic indicators for Indonesia in *World Population Prospects: the 2002 Revision*. We also compare our results with published life tables produced by the WHO.

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[2] Public use data were provided by Dr. Salahudin Muhidin (University of Montreal).

[3] UN data were provided by Drs. Robert Retherford (East-West Center) and Sabine Henning (UN Population Division).

Preliminary Results
At the current stage of our research, we have prepared the datasets and conducted preliminary analyses as described above.

We first modeled mortality in the IFLS using hazard modeling with age and sex as covariates. We tested a variety of interactions and nonlinearities of age but found that a Gompertz age specification with a proportional effect of sex fit the data the best. Second, we used the GGB technique to assess and adjust the SUSENAS data. Third, we created preliminary life tables from these techniques, presented in Appendices A-C.

A comparison of our life expectancies from our preliminary analyses is presented in Table 1. The results show that similarities in life expectancy estimates between the IFLS and SUSENAS vary by age and sex. For men, estimates tend to be closer at the older age groups while for women, estimates tend to diverge in these age groups. It seems that IFLS estimates are a bit higher than SUSENAS estimates for women but not so much for men. Comparing IFLS and SUSENAS to WHO expectancies for men, however, we find that IFLS' expectancies are consistently higher but closer to WHO expectancies than expectancies from SUSENAS. Lastly, we find that the survey life expectancies (IFLS and SUSENAS) are more similar to each other than to the model life table estimates (UN and WHO).

Conclusion
Without a reliable civil registration system, Indonesia had to mainly rely on model life tables to describe its mortality schedule. However, the approximations from Model West life tables have been questioned (Heligman 1975; Sinquefield and Kartoyo 1977; McDonald 1978; Gardiner 1978; Agung et al., 1997; Muhidin 2002) since they are not based on Indonesia's own demographic experience. In this paper, we develop alternate models of Indonesian mortality using survey data from the SUSENAS and IFLS and used the General Growth Balance technique to adjust the SUSENAS, and estimated mortality risk of the IFLS using hazard modeling. We then created and compared standard life tables using these data to UN and WHO life tables based on Model West life tables. We find the results to be fairly consistent across the various models with some variations depending on age and sex. In the full paper, we plan to elaborate on the discrepancies of these estimates, concerns on using survey data to estimate the population, as well as concerns with model life table assumptions. We conclude that generally the IFLS data serve as a stronger source for mortality analysis because, unlike other available sources, it is based on observed mortality rather than indirectly measured mortality or model life tables. Furthermore, although the IFLS is representative of 83 percent of the Indonesian population (as opposed to the SUSENAS' nationally representative sample), it seems to capture the overall pattern of mortality and mortality estimates from the IFLS are consistent with the population on which it is based.

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Table 1. Predicted Life Expectancies for IFLS Respondents (1993-1997), and SUSENAS (1996-1998), UN (1990-1995 and 1995-2000), and World Health Organization Life Expectancies (2000)

Panel A: Men

	IFLS	SUSENAS	WHO
e10	60.3	62.2	57.8
e20	50.9	53.2	48.6
e30	46.3	44.1	39.7
e40	33.4	35.0	30.9
e50	25.7	26.6	22.7
e60	19.0	19.0	15.5
e70	13.6	12.5	9.7

Panel B: Women

	IFLS	SUSENAS	WHO
e10	64.8	64.3	61.2
e20	55.3	55.2	51.8
e30	46.1	46.3	42.7
e40	37.4	37.4	33.7
e50	29.5	28.7	25.3
e60	22.5	20.5	17.5
e70	16.9	13.0	10.9

Panel C: Both

	UN (1990-1995)	UN (1995-2000)
e10	58.4	59.8
e20	49.3	50.5
e30	40.5	41.6
e40	31.8	32.7
e50	23.6	24.3
e60	16.1	16.6
e70	9.9	10.3

Appendix A

IFLS Life Table 1993-1997: Males

Age	m(x)	q(x)	l(x)	d(x)	L(x)	T(x)	e(x)
5-9	0.00083	0.00331	100000	331	499172	6506778	65.1
10-14	0.00115	0.00459	99669	458	497201	6007605	60.3
15-19	0.00160	0.00636	99211	631	494478	5510405	55.5
20-24	0.00221	0.00882	98580	869	490726	5015926	50.9
25-29	0.00307	0.01222	97711	1194	485569	4525200	46.3
30-34	0.00426	0.01691	96517	1632	478505	4039631	41.9
35-39	0.00592	0.02338	94885	2219	468878	3561126	37.5
40-44	0.00821	0.03230	92666	2993	455849	3092248	33.4
45-49	0.01139	0.04453	89673	3993	438384	2636399	29.4
50-54	0.01580	0.06125	85680	5248	415282	2198015	25.7
55-59	0.02192	0.08396	80433	6753	385280	1782733	22.2
60-64	0.03042	0.11456	73680	8441	347295	1397452	19.0
65-69	0.04221	0.15534	65239	10134	300857	1050157	16.1
70-74	0.05856	0.20883	55104	11507	246753	749299	13.6
75+	0.08675	1.00000	43597	43597	502546	502546	11.5

IFLS Life Table 1993-1997: Females

Age	mx	qx	lx	dx	Lx	Tx	ex
5-9	0.00065	0.00259	100000	259	499353	6959203	69.6
10-14	0.00090	0.00359	99741	358	497810	6459850	64.8
15-19	0.00125	0.00498	99383	495	495678	5962040	60.0
20-24	0.00173	0.00690	98888	682	492735	5466362	55.3
25-29	0.00240	0.00956	98206	939	488681	4973628	50.6
30-34	0.00333	0.01324	97267	1288	483113	4484947	46.1
35-39	0.00462	0.01833	95978	1759	475495	4001834	41.7
40-44	0.00642	0.02534	94219	2387	465129	3526339	37.4
45-49	0.00890	0.03498	91832	3213	451128	3061211	33.3
50-54	0.01235	0.04821	88619	4272	432416	2610083	29.5
55-59	0.01714	0.06626	84347	5589	407764	2177667	25.8
60-64	0.02378	0.09074	78758	7146	375926	1769903	22.5
65-69	0.03299	0.12364	71612	8854	335925	1393977	19.5
70-74	0.04578	0.16733	62758	10501	287535	1058053	16.9
75+	0.06782	1.00000	52256	52256	770517	770517	14.7

Appendix B

UN Life Table 1990-1995 for Both Sexes

Age	m(x)	q(x)	l(x)	d(x)	L(x)	T(x)	e(x)
0	0.060358	0.058590	100000	5859	97071	6267721	62.7
1	0.005395	0.021351	94141	2010	372544	6170651	65.5
5	0.001595	0.007945	92131	732	458825	5798107	62.9
10	0.001245	0.006204	91399	567	455578	5339282	58.4
15	0.001905	0.009479	90832	861	452008	4883704	53.8
20	0.002613	0.012982	89971	1168	446935	4431697	49.3
25	0.002965	0.014718	88803	1307	440748	3984762	44.9
30	0.003354	0.016629	87496	1455	433843	3544014	40.5
35	0.004114	0.020362	86041	1752	425825	3110172	36.1
40	0.005335	0.026326	84289	2219	415898	2684347	31.8
45	0.007326	0.035969	82070	2952	402970	2268449	27.6
50	0.010528	0.051290	79118	4058	385445	1865479	23.6
55	0.015594	0.075047	75060	5633	361218	1480034	19.7
60	0.023713	0.111931	69427	7771	327708	1118817	16.1
65	0.036920	0.169002	61656	10420	282230	791109	12.8
70	0.057643	0.251913	51236	12907	223913	508879	9.9
75	0.096104	0.387435	38329	14850	154520	284967	7.4
80	0.153570	0.554836	23479	13027	84828	130447	5.6
85	0.211541	0.691829	10452	7231	34183	45619	4.4
90	0.267738	0.801925	3221	2583	9648	11437	3.6
95+	0.356529	1	638	638	1789	1789	2.8

UN Life Table 1995-2000 for Both Sexes

Age	m(x)	q(x)	l(x)	d(x)	L(x)	T(x)	e(x)
0	0.049621	0.048420	100000	4842	97579	6517311	65.2
1	0.003793	0.015059	95158	1433	377766	6419732	67.5
5	0.001231	0.006135	93725	575	467188	6041966	64.5
10	0.000977	0.004874	93150	454	464615	5574779	59.8
15	0.001542	0.007681	92696	712	461700	5110164	55.1
20	0.002133	0.010611	91984	976	457480	4648464	50.5
25	0.002410	0.011977	91008	1090	452315	4190984	46.1
30	0.002732	0.013568	89918	1220	446540	3738669	41.6
35	0.003402	0.016866	88698	1496	439750	3292129	37.1
40	0.004563	0.022557	87202	1967	431093	2852379	32.7
45	0.006474	0.031853	85235	2715	419388	2421286	28.4
50	0.009493	0.046365	82520	3826	403035	2001899	24.3
55	0.014302	0.069040	78694	5433	379888	1598864	20.3
60	0.022026	0.104380	73261	7647	347188	1218976	16.6
65	0.034724	0.159752	65614	10482	301865	871789	13.3
70	0.055387	0.243253	55132	13411	242133	569924	10.3
75	0.088801	0.363342	41721	15159	170708	327791	7.9
80	0.139015	0.515812	26562	13701	98558	157084	5.9
85	0.200490	0.667755	12861	8588	42835	58526	4.6
90	0.258651	0.785397	4273	3356	12975	15691	3.7
95+	0.337568	1	917	917	2716	2716	3.0

Appendix C

SUSENAS Adjusted Life Table 1996-1998: Males

Age	m(x)	q(x)	l(x)	d(x)	L(x)	T(x)	e(x)
0-4	0.03266		NA		NA	NA	NA
5-9	0.00457	0.01136	100000	1136	497161	6651008	66.5
10-14	0.00280	0.00697	98864	690	492598	6153847	62.2
15-19	0.00359	0.00894	98175	878	488680	5661248	57.7
20-24	0.00423	0.01051	97297	1023	483929	5172568	53.2
25-29	0.00367	0.00914	96274	880	479170	4688639	48.7
30-34	0.00406	0.01011	95394	964	474560	4209469	44.1
35-39	0.00505	0.01253	94430	1184	469190	3734909	39.6
40-44	0.00866	0.02143	93246	1998	461237	3265719	35.0
45-49	0.01196	0.02945	91248	2687	449525	2804482	30.7
50-54	0.01903	0.04645	88561	4114	432523	2354957	26.6
55-59	0.02449	0.05938	84448	5015	409702	1922434	22.8
60-64	0.03953	0.09410	79433	7474	378480	1512732	19.0
65-69	0.04932	0.11600	71959	8347	338927	1134251	15.8
70-74	0.06968	0.15987	63612	10169	292635	795325	12.5
75+	0.12654	1.00000	53442	53442	502689	502689	9.4

SUSENAS Adjusted Life Table 1996-1998: Females

Age	m(x)	q(x)	l(x)	d(x)	L(x)	T(x)	e(x)
0-4	0.03626		NA		NA	NA	NA
5-9	0.00547	0.01357	100000	1357	496607	6840722	68.4
10-14	0.00308	0.00767	98643	757	491322	6344116	64.3
15-19	0.00302	0.00751	97886	735	487592	5852794	59.8
20-24	0.00398	0.00989	97151	961	483351	5365202	55.2
25-29	0.00412	0.01025	96190	986	478483	4881851	50.8
30-34	0.00527	0.01310	95204	1247	472901	4403367	46.3
35-39	0.00555	0.01379	93957	1296	466545	3930466	41.8
40-44	0.00729	0.01806	92661	1674	459122	3463922	37.4
45-49	0.00846	0.02093	90988	1904	450177	3004800	33.0
50-54	0.01353	0.03325	89083	2962	438011	2554623	28.7
55-59	0.01581	0.03876	86121	3338	422261	2116611	24.6
60-64	0.02747	0.06636	82783	5494	400182	1694350	20.5
65-69	0.03261	0.07828	77290	6050	371322	1294168	16.7
70-74	0.05098	0.11965	71239	8524	334886	922847	13.0
75+	0.12116	1.00000	62715	62715	587961	587961	9.4