USING INDIRECT DEMOGRAPHIC MODELS TO ASSESS THE COVERAGE OF VITAL REGISTRATION DATA

A. Sinan TÜRKYILMAZ*
Erhan ÖZDEMİR**
İsmet KOÇ***
Oona M.R.CAMPBELL****

Vital registration is of sufficient quality to be used for adult mortality in many countries. We used Brass Growth-Balance and Preston-Coale techniques to assess coverage of burial register and developed an approach using West and East model life-tables to assess internal consistency. We found death registration missed about a third of deaths, and was worse for females and Turkey could expect between 42-49% of its deaths to be female and 7-20% of those to be aged 15-49 which is more susceptible to model choice. These percentages may be useful for rapid quality assessment in settings with little demographic analytic capability.

1. INTRODUCTION

Vital registration should be a major source of mortality data, however only about a third of deaths worldwide are registered at all, and many of these have poorly ascribed causes of death. A World Health Organization assessment of 192 countries suggests that only 115 have usable data, of which only 66 have a high coverage of deaths (WHO, 2010). Reliable information on the numbers and causes of adult deaths tends to come largely from developed countries or from very small developing countries. An older generation of demographers points to failed investments (made in the 1960s and 1970s by UNFPA among others) to improve vital registration in developing countries, and has discounted the use of vital registration in developing countries.

Global household-survey programs, such as the Demographic and Health (DHS), Pan Arab Project for Child Health (PAP Child) and Multiple Indicator Cluster (MICS) surveys, have become alternative sources of mortality data, and consequently most countries have reasonable national estimates of infant and child mortality. However, sample-size constraints mean these sources are less adequate for sub-national estimates or for measuring adult mortality. The latter remain based on models such as life tables or the Global Burden of Disease (GBD) package.

Because of these limitations of survey data, there is a growing realization of the need for vital registration to provide sub-national data and to measure rarer events such as cause-specific adult deaths (e.g. maternal mortality). International initiatives include the Health Metrics Network ("critical path" towards strengthening vital events systems), scaled-up global resources for fighting HIV/AIDS (PEPFAR, 3 by 5, Global Fund, World Bank MAP), SAAVY, and efforts by other initiatives (Roll Back Malaria, Stop TB, Safe Motherhood, Poverty Reduction, and sector-based reforms).

*Instructor, Hacettepe University Institute of Population Studies
**Ph.D. student, Hacettepe University, Institute of Population Studies
***Associated Professor, Hacettepe University, Institute of Population Studies
****Reader, London School of Hygiene & Tropical Medicine, Infectious Diseases Epidemiology Unit

We support the call to begin to use death registration data and to develop pragmatic tools to look at data quality. Existing demographic techniques like Preston-Coale Method or Brass's Growth Balance Method use census and vital registration data to assess the overall coverage quality of death registers. These methods are indirect and complex, and are of limited use in understanding quality beyond very basic sex and age structure relationships. For this reason, there is also a need to couple these methods with other model-based analyses, such as construction of Coale-Demeny's regional model life tables using early-age mortality indicators and patterns as input, so as to be able to assess data quality. Determining simple relationships that obviate the need for complex analyses would be particularly useful at the provincial level, where access to demographers is limited.

Turkey is a middle-income country with a population of 73 million. It is divided into five regions, 12 NUTS-I regions, 26 NUTS-II regions, and 81 provinces (NUTS-III regions). One of the most important problems facing demographers studying Turkey's population is the lack of vital registration with adequate coverage of births, deaths and population size. Although satisfactory denominators for calculating age and sex specific populations can be obtained by using census projections (with several assumptions), these remain indirect approximations of real population size. Moreover, the situation is more ambiguous for the numerators of key demographic indicators. The completeness of the Population and Citizenship Affairs General Directorate's MERNIS data (NVİGM, 2006) Turkey's vital registration system, for births and deaths is thought to be low, which does not allow the direct calculations. A working group study which focuses on the death and birth registers in Turkey stating that there is 20-25 percent under-coverage for the number of deaths (DİE, 1997). Furthermore, our unpublished assessment of vital events quality collected in the 2000 census is that they are poor; they do not reflect the correct levels of fertility on the one hand or the indicators for infant and child mortality as calculated by indirect techniques (Brass's children ever born/children surviving method) on the other.

The 2003 Turkey Demographic and Health Survey (TDHS-2003) conducted by Hacettepe University Institute of Population Studies does, by contrast, provide consistent data on current demographic trends in Turkey. The main scope of THDS-2003 mortality analysis is to estimate early-age mortality indicators but it is possible to derive adult mortality using these early-age mortality indicators under several assumptions. However, despite its higher representativeness and completeness, TDHS-2003 is limited by its sample-size. Although national, regional and urban-rural estimates for infant and child mortality can be obtained, it is not possible to produce province level information.

This paper seeks to establish the completeness of Turkish MERNIS data and to determine whether relationships exist between the sexes and between certain age groups that can be used to get a sense of data quality. In particular, it seeks to establish whether the proportions of total female deaths among overall deaths and the proportions of female deaths in 15-49 age group among total female deaths follow a specific, easily described, pattern. This question arose in the specific context of looking at cemetery data in Turkey as part of a reproductive age mortality study (RAMOS) of maternal mortality that is identifying female deaths from burial registration in 27 of 81 provinces. This research needed tools that would help assess the quality of cemetery data without resorting to complex demographic techniques. In Turkey, death information in this context has not been described before to our knowledge.

2. METHODS

Methods for looking at coverage of death registration include Preston-Coale, Brass Growth balance, Horiouchi and Bennet (Arriaga 1994). In our paper, Preston Coale and Brass Growth balance techniques were used to assess the coverage of the 2003 data collected by the MERNIS system as these are the most widely used.

2.1. Preston-Coale Technique

The Preston-Coale method estimates the completeness of reported number of deaths assuming a stable population (no migration and unchanging fertility and mortality). Basically, if N(x) is the number of persons at age x, r is the growth rate and D(x) is the number of deaths in age x, then;

$$\overline{N}(x) = \sum_{a=x}^{\omega} D(x) * e^{r*(a-x)} \quad (1)$$

where $\overline{N}(x)$ is the estimated number of persons at age x. According to this relation, the error for the death registers are found out by the median of C values for each age group that are calculated by the formula

$$C = \frac{\sum_{x=0}^{\omega} {}_5\overline{N}_x}{\sum_{x=0}^{\omega} {}_5N_x} \quad (2)$$

There are special calculation procedures for the last age group, in which some coefficients are used to compute $\overline{N}(x+)$. These use Coale-Demeny model life tables. The Preston-Coale method can be misleading where the choice of growth rate is incorrect, where there is upward displacement of the age at death, or where there are departures from stability (UN 1983). Preston-Coale analyses for males and females were conducted using PASEX PRECOA sheet (Arriaga 1994). Overall growth rates were taken as 0.0182854 for males and 0.018286 for females based on 1990 and 2000 Population Censuses (SIS 1994; SIS 2004) and East and West model life tables' coefficients were used.

2.2. Brass's Growth Balance Technique

Brass's Growth Balance technique (Brass 1975, UN 1983, Preston et all, 2001) is also based on stable population assumption, and takes the formula below as its basis:

$$\frac{N(x)}{N(x+)} = r + \frac{D*(x+)}{N(x+)} \quad (3)$$

In this formula, N(x) is the number of persons in exact age x, N(x+) is the total population up to age x, D*(x+) is the total number of deaths from age x and over and r is the growth rate. This formula can also be written as

$$\frac{N(x)}{N(x+)} = r(x+) + \frac{D^*(x+)}{N(x+)} \quad (4)$$

So, left side of equation presents the birth rate for population from age x and over, $\frac{D^*(x+)}{N(x+)}$ is the death rate for the same population group and r is the growth rate of this population. In real populations, number of deaths has an error, which can be shown as

$$D(x+) = C(x)D^*(x+)$$

where C(x) equals to 1/K. K is calculated as

$$K(x) = \frac{N(x) + rN(x+)}{D(x+)} \quad (5)$$

2.3. Data and Methods for Model Life Tables Approach to looking at Quality of Death Registers

To go beyond examining the levels of coverage, we also undertook a more detailed analysis of the anticipated age and sex distribution of the deaths in order to evaluate the data quality of a given register data. To derive these anticipated age and sex distributions we used TDHS-2003 results together with the 2000 population census (SIS 2003) to calculate the estimated numbers of male and female deaths and the proportion of female deaths among total deaths in 27 provinces studied for the Turkey Maternal Mortality Study. TDHS-2003 is a weighted, multi-stage, stratified, cluster sample survey (Turkyilmaz, Hancioglu and Koç 2004) that provides demographic and health information, including on current fertility and early-age mortality trends, household characteristics, maternal and child health, migration and aging. The lowest level of disaggregation for which the TDHS-2003 provides precise estimates of early-age mortality is the regional level, namely West, South, Central, North and East regions. Although the sampling design of TDHS-2003 enables calculations to be made for the 12 regions of NUTS-I level, the observed infant and under-five deaths are too few to compute trustworthy rates on this level. Therefore we grouped our provinces into the five Turkish regions.

Despite this, there remained some problems in estimating applicable sex-specific early-age mortality rates on five-region level for reasons similar to the difficulty faced with the 12 NUTS-I regions, namely that the observed male and female deaths in 0-4 age group were insufficient for estimations. Therefore, some assumptions were introduced. The West and East models of the Coale-Demeny regional model life-tables were used to determine the overall mortality levels of the regions by using combined under-five mortality probabilities (${}_5q_0$). These levels were then used to estimate separate male and female life tables (UN 1983). The ${}_5q_0$ values were used because they were a more cumulative indicator for early-age mortality and because ${}_1q_0$ and ${}_4q_1$ values might have produced inconsistent outcomes for regions with fewer observations.

The assumption of model life tables is that there is a linear relation in the differentiation between levels of model life tables (Coale and Demeny 1983, UN 1983), and a single mortality indicator, such as life expectancy at age x or probability of dying at age x, is sufficient to calculate values in other age groups, because other age groups also move linearly from one model life table level to the next. If θ is assumed to be the distance of empirical population's mortality from the lower model life table level, then it can be calculated as:

$$\theta = \frac{q(x)^{emprical} - q(x)^{n}}{q(x)^{n+1} - q(x)^{n}} \quad (6)$$

e(x) values can also be used in calculating θ, where q(x)n is the q(x) value of the lower level and q(x)n+1 indicates the q(x) value of the upper level of the model life tables. This value is used to interpolate other q(x) values by the formula

$$q(i)^{emprical} = (1-\theta) * q(i)^{n} + \theta * q(i)^{n+1} \quad (7)$$

After finding the estimated level using the model life tables, age-specific numbers of deaths were calculated as

$$d(x) = m(x) * n(x) \quad (8)$$

where m(x) was the central death rate of age group x in the constructed life table and n(x) was the population size of age group x. The same calculation procedure was applied to all age groups and total number of deaths equals to the sum of d(x) values in each age group.

Previous literature on mortality patterns in Turkey has used either Coale-Demeny's West or East model life table families (Shorter and Macura 1982, Hancioglu 1991, Turkyilmaz 1998, Toros 2000, Coskun 2002). The choice of the West and East model in our paper is based on some specific characteristics of these families of model life tables. There are obvious differences in mortality schedules among the different geographical regions, and also across urban and rural residence and across provinces of within each region. The West model is intermediate between East, South and North models of Coale-Demeny regional model life tables and is widely used in the absence of other information. The East model, on the other hand, appears to best reflect the age pattern of mortality in Turkey, although it is difficult to be certain as critical fertility and mortality transitions have been experienced in the last three decades in Turkey.

A further assumption in our analysis was that proportions of female deaths observed may vary regionally. In order to cover the possible variations, the lower and upper bounds for each region's sex-specific mortality rates were computed by using (-)1 and (+)1 standard errors for under five mortality in TDHS-2003 main report (Turkyilmaz 2004). The necessary values for finding region-specific overall mortality levels using combined probabilities were taken from Manual X (UN 1982). It used combined West survivorship ratios according to a sex ratio at birth of 1.04, the sex ratio at birth seen in TDHS-2003 (HUIPS 2004).

After finding the life-table levels, male and female life tables were calculated using MORTPAK 4 software for regions. The assumption in this phase of analysis was that male and female mortality levels were equal within combined levels of mortality. Finally, we constructed thirty life-tables, which contained upper and lower boundaries for (-) 1 and (+) 1 standard errors and observed under-five probabilities.

The last operation to estimate the expected numbers of total male and female deaths in 27 provinces was to multiply each province's age-specific populations from 2000 census (DIE 2003) with annual central death rates taken from the constructed life tables and the proportions of female deaths within total deaths.

3. RESULTS

The results of the assessment of coverage are in section 3.1 while those of internal consistency are in section 3.2.

3.1. Data Quality of Death Registers in Turkish Case

The Preston-Coale cumulative completeness of deaths was calculated for the 5-85 age group. It showed cumulative completeness of the MERNIS death registers to be 72 percent for males and 69 percent for females, and 70 percent overall. According to the Growth-Balance method, completeness for the 5-60 age range was 73 per cent for male death registrations and 65 percent for females and 67 percent overall.

3.2. Findings sex and age

The upper, lower and current levels of overall mortality of regions are given in Table1 below

Table 1. Mortality Levels of Regions of Turkey according to Coale Demeny Model West and Coale Demeny Model East

Turkish Regions	*Coale Demeny Model West*			*Coale Demeny Model East*		
	+1 SE	-1 SE	Observed	+1 SE	-1 SE	Observed
West	21.67	22.71	22.16	22.31	23.29	22.78
South	21.47	22.89	22.14	22.11	23.48	22.75
Central	21.35	22.60	21.94	21.98	23.19	22.57
North	19.74	21.99	20.77	20.43	22.63	21.45
East	20.34	21.11	20.72	20.99	21.78	21.39

Tables 2 and 3 present the proportions of female deaths in provinces. The last two columns (5 and 6) display the difference between upper and lower boundaries.

Table 2. Expected Proportions of Female Deaths within Total Deaths (West Model)

Turkish regions (1)	27 provinces selected for Maternal Mortality study (2)	Estimated (3)	Lowest [a] (4)	Highest [b] (5)	Width of interval (6)
West	Aydin	48.0	44.4	51.8	7.4
	Balikesir	47.3	43.9	50.8	6.9
	Bursa	47.5	43.5	51.5	8.0
	İstanbul	48.5	44.1	52.9	8.8
	İzmir	48.5	44.7	52.4	7.7
	Sakarya	47.2	43.3	51.2	7.9
	Tekirdağ	46.8	43.1	50.7	7.6
South	Adana	46.9	40.5	53.4	12.9
	Burdur	47.9	43.3	52.7	9.4
	Kahramanmaraş	43.8	37.7	50.2	12.5
Central	Ankara	47.7	42.7	52.7	10.0
	Çankiri	44.6	40.3	48.9	8.5
	Kütahya	45.3	40.8	49.9	9.1
	Nevşehir	47.2	42.6	51.8	9.2
	Sivas	44.4	39.8	49.2	9.4
	Tokat	44.6	39.7	49.7	10.0
	Karaman	45.6	41.0	50.3	9.2
North	Giresun	48.8	42.4	55.2	12.8
	Ordu	46.7	39.6	53.9	14.3
	Bartin	48.8	42.5	54.9	12.5
East	Ağri	43.1	39.5	46.5	7.1
	Diyarbakir	44.6	41.0	47.9	6.9
	Gaziantep	46.9	43.7	49.9	6.2
	Malatya	45.5	42.8	48.0	5.2
	Van	43.5	39.6	47.2	7.6
	Bayburt	46.3	43.9	48.7	4.8
	Batman	45.3	41.6	48.7	7.1

a: Overall mortality level of males is (+)1 SE and overall mortality level of females is (-)1 SE from current estimation

b: Overall mortality level of males is (-)1 SE and overall mortality level of females is (+)1 SE from current estimation

Table 3. Expected Proportions of Female Deaths within Total Deaths (East Model)

Turkish regions (1)	27 provinces selected for Maternal Mortality study (2)	Estimated (3)	Lowest [a] (4)	Highest [b] (5)	Width of interval (6)
West	Aydin	46.9	43.4	50.4	7.0
	Balikesir	46.1	42.8	49.4	6.6
	Bursa	46.3	42.5	50.0	7.5
	İstanbul	47.4	43.3	51.5	8.2
	İzmir	47.3	43.7	50.9	7.3
	Sakarya	46.1	42.4	49.8	7.4
	Tekirdağ	45.7	42.1	49.3	7.2
South	Adana	45.7	39.6	51.8	12.2
	Burdur	46.9	42.3	51.3	9.1
	Kahramanmaraş	42.8	36.8	48.7	11.9
Central	Ankara	46.5	41.8	51.1	9.3
	Çankiri	43.3	39.3	47.4	8.1
	Kütahya	44.0	39.7	48.3	8.5
	Nevşehir	46.0	41.6	50.3	8.7
	Sivas	43.1	38.7	47.6	8.9
	Tokat	43.3	38.7	48.0	9.4
	Karaman	44.4	40.1	48.7	8.7
North	Giresun	47.9	41.4	54.7	13.3
	Ordu	45.6	38.5	53.1	14.6
	Bartin	47.7	41.3	54.3	13.0
East	Ağri	41.8	38.2	45.5	7.3
	Diyarbakir	43.3	39.8	46.9	7.1
	Gaziantep	45.8	42.5	49.1	6.5
	Malatya	44.3	41.5	47.0	5.5
	Van	42.3	38.4	46.2	7.8
	Bayburt	45.2	42.6	47.8	5.3
	Batman	44.2	40.5	47.9	7.4

a: Overall mortality level of males is (+)1 SE and overall mortality level of females is (-)1 SE from current estimation

b: Overall mortality level of males is (-)1 SE and overall mortality level of females is (+)1 SE from current estimation

Table 4 presents the expected proportions of female deaths aged 15-49 among all female deaths and the difference between West and East model life tables in terms of these expected proportions of females aged 15-49.

Table 4. Expected Proportions of Female Deaths aged 15-49 among all female Deaths (West and East Model)

Turkish regions (1)	27 provinces selected for Maternal Mortality study (2)	% of deaths aged 15-49 among all female deaths West Model (3)	% of deaths aged 15-49 among all female deaths East Model (4)	% Difference between West and East Models (5)
West	Aydin	11.0	8.5	2.5
	Balikesir	9.7	7.5	2.2
	Bursa	13.0	10.2	2.8
	İstanbul	15.5	12.1	3.4
	İzmir	12.5	9.7	2.8
	Sakarya	12.1	9.4	2.7
	Tekirdağ	12.3	9.6	2.7
South	Adana	16.4	12.9	3.5
	Burdur	9.3	7.2	2.1
	Kahramanmaraş	14.4	11.1	3.3
Central	Ankara	15.7	12.2	3.5
	Çankiri	10.4	8.0	2.4
	Kütahya	12.7	9.9	2.8
	Nevşehir	12.0	9.2	2.8
	Sivas	12.0	9.3	2.7
	Tokat	13.3	10.4	2.9
	Karaman	12.1	9.3	2.8
North	Giresun	11.4	8.4	3.0
	Ordu	14.2	10.6	3.6
	Bartin	12.6	9.4	3.2
East	Ağri	18.5	13.8	4.7
	Diyarbakir	19.1	14.2	4.9
	Gaziantep	18.0	13.4	4.6
	Malatya	16.9	12.6	4.3
	Van	19.6	14.6	5.0
	Bayburt	13.1	9.7	3.4
	Batman	17.8	13.1	4.7

4. DISCUSSION AND CONCLUSION

This paper looks at the coverage and internal consistency of Turkey's cemetery burial data. The indirect techniques used to look at the sex and age distribution of registered deaths highlighted several issues in studying and evaluating the data quality of limited death registration systems. Preston-Coale and Brass's Growth Balance techniques showed that around a third of overall deaths were missing in Turkey. Also, although both male and female deaths are under-registered, Preston-Coale and Brass's methods similarly indicated a more serious under-coverage problem for female population, with a 4 percent to 8 percent coverage difference between male and female deaths. If the assumption of no migration is violated, the completeness would be somewhat different than our calculation.

Both results highlight a serious problem of under-registration of deaths in Turkey. We were unable to identify any published estimates of completeness of death registration, but our findings agree with informal assessments. This suggests direct use of vital registers in Turkey is inappropriate, and that sustained efforts are needed to improve death reporting, especially for females.

The two methods applied to look at coverage were insufficient to examine age and sex-specific patterns of proportions in overall deaths and in the same sex. Therefore, the more detailed analysis of age and sex specific deaths was necessary to evaluate the data quality of a given register data according to age distribution and sex proportions of the deaths. When the expected proportions of the total female deaths within the total deaths of the given provinces were examined (column 2s of Table 2 and Table 3), none of these proportions exceeded 49 percent of total deaths. This is because mortality rates of females are always lower than those of males in Coale and Demeny's model life tables in the same mortality level of the same model life table family. The differentiation in the width of intervals among provinces was related first to the age structure of the provinces and second to the variations in the size of standard errors of ${}_5q_0$, which were affected by numbers of observation.

It would seem possible to recommend that a "quick-and-dirty" check which showed females to be between 42 to 49 percent of deaths would indicate an acceptable quality of female relative to male deaths. Percentages beyond this range would need assessment by a demographer to look at other variables such as age and sex distribution and the model life table level for the specific population.

The proportions in Table 4 by age were between 7-20 per cent. This suggests this may be a more problematic category to use for looking at data quality than the proportion females. Comparison of the use of West and East model for the proportion of female deaths in overall deaths (Tables 2 and 3) and especially the proportion of 15-49 female deaths within total female deaths (Table 4) points out some significant cautions in terms of preference of the model life table adopted to describe the expected mortality pattern of the population in question. Although the differences between current, lowest and highest estimations of the proportion of female deaths according to West and East models in overall deaths are about 1 percent, which equals to 1.5 percent to 3.0 percent deviation when the West model is taken as the base, differences between the proportions of 15-49 female deaths in total female deaths for West and East model get values between 2.2 to 5.0 percent that indicates the 21.1 percent to 26.3 percent deviations from the West model. On the contrary, the selection of either West or East model does not influence the width of the intervals between the highest and lowest levels of female and male deaths.

There should be a tolerance interval for the proportion calculations by using model life tables. In the case where the sex-specific mortality indicators are absent, it is hard to determine whether the mortality levels of males and females are same or not and it would be misleading to assume that they are equal. Therefore, if there is a data for standard errors of 1q0 or 5q0 like DHS-type surveys, adopting margin of errors into the procedures would give more satisfactory indicators. In fact, regions, which have insufficient number of cases may have broader intervals that may explain the possible gaps between male and female death proportions.

Model selection is an important question for the users. Turkey has a literature on the discussions on which Coale-Demeny regional model life table family is more appropriate for studying mortality pattern of the country. However, case of each country varies because of its specific experience of mortality transition, which is related to socio-economic development level, health system, epidemics like malaria and HIV/AIDS, wars and other geographical factors. In other words, users of the model life tables in this context need to be aware of their country's conditions and demographic and epidemiological characteristics in order to choose the most appropriate model. As described in the third section, even the use of West and East models in the same population may differ in proportions. In addition to this, age structure, fertility, mortality and migration patterns of the given population are other important factors shaping overall mortality patterns.

In summary, we found that Turkish death registration data miss about a third of deaths and that the problem is worse for females than males. Efforts need to be made to address this problem before vital registration data can be used. We also found using West and East model life tables that Turkey predict between 42-49 percent of its deaths to be female. Values outside this range would need more in-depth assessment before their quality was judged acceptable. Similarly the proportion of deaths in the age range of 15-49 is in the range of 7-20 percent. This is a wider range and is more susceptible to model choice. This it may be of limited value in looking at data quality. More research is needed in different settings. In conclusion, it can be argued that direct calculations for looking at the quality of a death register system can provide a limited supplement to evaluation of quality of death data by using indirect techniques such as Growth Balance and Preston-Coale.

5. REFERENCES

Arriaga, E. E. (1994) **Population Analysis with Microcomputers, Volume I**, Bureau of the Census, USAID and UNFPA.

Brass, W. (1975) **Methods for Estimating Fertility and Mortality from Limited and Defective Data**, Cape Hill: The University of North Carolina.

Coale, A., J. and Demeny, P. (1983) **Regional Model Life Tables and Stable Populations**, New York: Academic Press.

Coşkun, Y. (2002) **Estimation of Adult Mortality by Using the Orphanhood Method from the 1993 and 1998 Turkish Demographic and Health Surveys**, unpublished MA dissertation submitted to Hacettepe University Institute of Population Studies, Department of Economic and Social Demography, 2002.

DİE (SIS) (1997), **Türkiye'de Doğum ve Ölüm Kayıtları İle İlgili Çalışma Grubu Raporu (A Working Group Report on Birth and Death Registers in Turkey)**, Yayın no (Publication no): 1999, ISBN:975-19-1633-X, Ankara.

Hacettepe University Institute of Population Studies (HUIPS) (2004), **Turkey Demographic and Health Survey 2003**, Hacettepe University Institute of Population Studies, Ministry of Heath General Directorate of Mother and Child Health and Family Planning, State Planning Organization and European Union. Ankara, Turkey.

Hancioglu, A. (1991) **Estimation of Levels and Trends in Mortality from Information on the Survival Status of a Close Relative Turkey 1970-1985**, unpublished Ph.D. dissertation submitted to Hacettepe University Institute of Population Studies Department of Technical Demography, 1991.

NVİGM (2006), **Nüfus İstatistikleri**, http://www.nvi.gov.tr/11,Ana_Sayfa_Nufus_Istatistikleri_Index.html, Son ziyaret tarihi:23.05.2006.

Preston, S.H., Heuveline, P. and Guillot (2001) **Demography: Measuring and Model in Population Processes**, Oxford: Blackwell

Shorter, F. and Macura, M. (1982), Trends in Fertility and Mortality in Turkey, 1935-1975, **Committee on Population and Demography**, Report No. 8, National Academy Press, Washington D.C..

State Institute of Statistics (SIS) (1994), **1990 General Population Census**, Ankara: SIS.

State Institute of Statistics (SIS) (2003), **2000 General Population Census**, Ankara: SIS.

Toros, A. (2000) 'Life Tables for the Last Decade of XXth Century in Turkey' in **Turkish Journal of Population Studies**, 2000, vol. 22, pp.57-110.

Türkyılmaz A.S. (1998) **Indirect Estimation of Infant Mortality and Under-Five Mortality Trends for Turkey From Birth-Survival Histories**, unpublished M.A. dissertation submitted to Hacettepe University Institute of Population Studies Department of Technical Demography, Ankara.

Türkyılmaz A.S., Hancıoğlu, A. and Koç, İ. (2004) ‘Appendix B: Survey Design’ in Hacettepe University Institute of Population Studies **Turkey Demographic and Health Survey 2003**, Hacettepe University Institute of Population Studies, Ministry of Heath General Directorate of Mother and Child Health and Family Planning, State Planning Organization and European Union. Ankara, Turkey, pp.167-185.

Türkyılmaz A.S. (2004) ‘Appendix C: Sampling Errors’ in Hacettepe University Institute of Population Studies **Turkey Demographic and Health Survey 2003**, Hacettepe University Institute of Population Studies, Ministry of Heath General Directorate of Mother and Child Health and Family Planning, State Planning Organization and European Union. Ankara, Turkey, pp. 187-210.

WHO (2010), **Global Mortality Data**,
http://www.who.int/mip/2003/other_documents/en/mortality.pdf,
Son ziyaret tarihi: 26.05.2010.

United Nations (1983), **Manual X Indirect Techniques for Demographic Estimation**, New York: United Nations.

ÖZET

HAYATİ KAYIT VERİSİNİN KAPSAMINI DEĞERLENDİRMEK İÇİN DOLAYLI DEMOGRAFİK MODELLERİN KULLANILMASI

Hayati kayıtlar bir çok ülkede yetişkin ölümlülüğünün kullanılması için yeterli kaliteye sahip değildir. Brass Growth-Balance ve Preston-Coale teknikleri mezarlık kayıtlarının kapsam ve Batı ve Doğu model hayat tabloları kullanılarak geliştirelen bir yaklaşımda iç tutarlık değerlendirilmelerinde kullanılmıştır. Ölüm kayıtlarında her üç ölümden birinin kaydedilmediği bulunmuş ve bu oranın kadınlar için daha yüksek olduğu görülmüştür, Türkiye'de model seçimine bağımlı olarak beklenen, kadın ölümlerinin toplam ölümler içindeki payının %42-49 arası, bunların içinde 15-49 yaşındaki kadın ölümlerin payının %7-20 arası olacağı beklenmektedir. Bu yüzdeler sınırlı demografik analiz kapasitesi olması durumlarında hızlı bir değerlendirme yapılması için yararlı olabilir.