Timor-Leste Population and Housing Census 2010

Analytical Report on Mortality

Volume 6

Timor-Leste 2010 Population and Housing Census

Series of Analytical Reports

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2010 Timor-Leste Population and Housing Census

Mortality Monograph

National Statistics Directorate (NSD)
United Nations Population Fund (UNFPA)

Foreword

The 2010 Timor-Leste Population and Housing Census with the theme "**Our Census, Our Future: Be part of it**" was conducted in July 2010 on a *de facto* basis by the National Statistics Directorate. The 2010 census is the second after the one conducted in 2004 (post independent Timor-Leste) and fourth after the 1980 and 1990, both taken under the Indonesian forced occupation. This census was undertaken within the provision of the Statistics Decree Law No. 17/2003 and the 2010 Population and Housing Census Law of April 2010.

The main objective of the census was to collect, analyze and effectively disseminate demographic and socio-economic information required for policy and programme formulation, decision making in planning and administrative processes, and research. The census preliminary results were published in Volume 1 and launched by His Excellency the President of the Republic of Timor-Leste in October 2010. The main results were published in Volumes 2, 3 and 4 and launched by the Vice-Prime Minister in July 2011. After that an ambitious "Sensus Fo Fila Fali" project was undertaken by the MDG Secretariat (Ministry of Finance) in partnership with the Census Project Office that culminated in a Census report for each of the 442 sucos in the country. These reports were launched by the Prime Minister in November 2011, followed by a series of nationwide dissemination workshops held at national, district level and in each of the 442 sucos.

This fourth phase comprises of twelve analytical reports covering the census thematic topics: Fertility and Nuptiality, Mortality, Migration and Urbanization, Population Projections, Education, Labour Force, Housing, Disability, Agriculture, Gender, Youth and the Atlas. The preparation of these reports was a collaborative effort between the Government of Timor-Leste and United Nations Population Fund (UNFPA); it involved local and international experts. The reports were authored under the supervision and guidance of the Chief Technical Adviser from UNFPA. The authors were recruited on competitive basis, ensuring that they had adequate knowledge of the topic they were to analyse.

The Government of Timor-Leste wishes to extend its sincere gratitude and thanks to UNFPA for providing technical, financial and administrative support throughout the census process. Further gratitude is extended to the authors of the analytical reports, the Director of NSD and his team, the Chief Technical Advisor – Census Project, technical staff for their commitment and tireless efforts to successfully undertake the thematic analysis exercise.

Last but not least, all Timorese deserve special praise for their patience and willingness to provide the requisite information which forms the basis of these reports and hence benchmark information for development. We in the Ministry of Finance and Government as a whole hope that the data contained in these twelve monographs will be fully utilized in national development planning process by all stakeholders for the welfare of the Timorese people.

Ms. Emilia Pires,

Minister of Finance

The Democratic Republic of Timor-Leste (RDTL)

Executive summary

This publication on Mortality is one of the thematic monographs prepared from the 2010 Population and Housing Census in Timor-Leste. The monograph presents the estimates of childhood mortality (infant mortality and under-five mortality rates), followed by estimates of adult mortality and expectation of life at various ages. It also illustrates the estimates of maternal mortality.

The measurement and analysis of infant and child mortality has received substantial attention especially, in the less developed countries, where a substantial number of deaths occur in early life. Saving children who are less than 5 years of age and especially less than 1 year, is a major public health concern, calling for accurate statistics and rigorous measures to identify the extent of the problem and monitor the progress in areas where intervention has been instituted.

In the less developed countries, vital registration systems are normally incomplete or inexistent. Under-five mortality is typically estimated with the so called *indirect methods*. The most frequently used indirect methods are the *Brass-type methods*. This approach was pioneered by William Brass and later improved by many other researchers overtime like, Trussell as well as the Palloni and Haligman versions (based on original Brass method); which have been used in this study to estimate infant and child mortality.

According to the 2010 Census, the infant mortality rate was 0.074, which corresponds to 74 deaths per 1,000 births. This value indicates a high infant mortality level. In more developed countries, infant mortality is only 6 deaths per 1,000 births, compared to the less developed countries, whose average rate is 46. Regarding child mortality, Timor-Leste exhibited a rate of 19 dead children aged 1 to 5 per 1,000 children who survive to the age of 5 yeras. This rate is higher than that estimated for the developed countries, which is just 2, but lower than the rate estimated for the less developed countries, which is 26. The level of child mortality is also high, but comparatively not as high as infant mortality.

The under-five mortality has experienced a substantial decline during the past decade. This was shown by an analysis based on the estimates from the 2010 Census data and other sources including the 2004 Census and the 2003 and 2009-10 Demographic and Health Surveys. Between the period 1998 to 2008, the infant mortality rate declined by 3.3 percent annually (from 120 to 74) and child mortality by 4.8 percent annually (from 38 to 19).

As mentioned earlier, reducing infant and child mortality is one of the most important public health concerns. Two groups of factors are important in this explanation: the development of health infrastructure (including public health and sanitation programs) and standards of living of the population (which include access to food, shelter, education, health services, among others). The relationships between these groups of variables and mortality are intricate and not always direct. One initial approach to the analysis of these relationships was by examination of *mortality differentials*, that is, by comparing the childhood mortality rates corresponding to different relevant population groups. Several differentials were calculated and are presented in this monograph.

In regard to sex differentials, infant mortality rate were slightly higher among boys than among girls in Timor-Leste. Child mortality was also a little higher among males, though the differences were almost negligible. Regarding the decline, rates for both sexes had dropped almost at the same pace during the period under consideration.

Urban-rural differentials were also considered. It refered to the usual place of residence of women during the census enumeration. The census results show that infant and child mortality was higher in rural areas than in urban areas. In rural areas the rate was 79 while in urban areas it was 62.Child mortality urban-rural differentials were substantial: 14 in urban areas and 21 in rural areas. In both rural and urban areas there was an improvement in infant and child survival during the period covered in the analysis (a decline of about 15% in both cases).

Differences in under-five mortality among the districts in the country were also estimated. Five districts (out of 13), showed a higher infant mortality rate than the national rate: Ainaro, Baucau, Bobonaro, Ermera and Viqueque. On the other hand, eight districts exhibited infant mortality rates below the national rate (74): Ailieu, Covalima, Dili, Liquica, Lautem, Manufahi, Manatuto and Oecussi. The lowest rate of 59 was exhibited in Dili district, where the capital city is located and the highest rate of 93 was in Ermera district.

Two variables on education of mothers were analyzed. The first was on literacy and the second on the educational level of mothers. According to the results, infants or children born from literate mothers were more likely to survive than children born from illiterate mothers. Similarly, children born from mothers with a primary level of education exhibited lower mortality rates than children born from women with no education at all, but higher rates compared to children born from women who had completed a secondary level of education.

Another important set of differentials that helped to clarify under-five mortality were characteristics of the housing unit, where the mother and infant or child resided. In this analysis, three housing unit characteristics were considered: material of the floor in the dwelling, source of water supply for drinking and means of sewage disposal. Children born in dwellings with constructed floors (tiles, wood, and cement) had better survival chances than children born in houses with soil floors. Dwelling's type of water for drinking was also related to infant and child mortality, although in this case differences were negligible. The reason of the modest difference that was found could have been the contamination of the sources, that were defined as hygienically secure (tap water, piped indoors or outdoors, protected well/spring and bottled water). It is likely that the hygienic quality of these sources was only marginally better than the other sources (tube well, rainwater collection, non-protected well/spring, water vendor, lake/stream and other) and, therefore, its effect on under-five survival was of more limited relevance than other dwelling characteristics. Finally, influence of the type of sewage disposal on infant and child mortality was analyzed. Infants and children living in dwellings with hygienically safe disposal (ventilated improved pit latrine, pour/flush to skeptical tank/pit) had much better survival chances than children living in dwellings with unsafe disposal (pit latrine without slab/open pit, hanging toilet/latrine, not facility or bush, other).

Child survival being a major public health concern, the measurement of early-age mortality has received a lot of attention in the mortality literature. Similarly, adult mortality has also become equally relevant. The ageing population in both the more and less developed countries, with the associated increased share of mortality that occurs in adulthood, has accentuated the need to obtain better estimates of mortality at adult ages. It is also important to note that the construction of accurate life tables, which are the most powerful instrument to analyze mortality, requires reliable adult mortality data.

During the 2000 and 2010 world round of censuses, it has become widespread to use a question on the number of deaths in the household during the past 12 months (by age and sex). With this question, direct estimates of mortality are obtained. This estimates for Timor-Leste indicated life expectancies of 58.72 years for males, 60.35 years for females and 59.48 years for both sexes. The gain with respect to the values estimated from the 2004 census is 1.32 and 1.45 years for males and females, respectively.

From the life tables the probability of dying between ages 15 and 60 (45q15) can be estimated. This is a frequently used indicator for adult mortality. For Timor-Leste, the probability of dying between ages 15 and 60 was 0.291 for males and 0.257 for females. These values are extremely high compared to the world differentials; which are 0.174 for males and 0.079 for females (in more developed countries) and 0.217 for males and 0.158 for females (in the less developed countries).

The last topic presented in this monograph is maternal mortality. In many less developed countries, maternal mortality rates are 100 times higher than in more developed countries. This difference has brought about the growing attention to the problem, which resulted into a substantial demand for maternal mortality estimates. However, the major problem has been the lack of data or rather the quality of the data available. Civil registration systems are the natural source of statistics on maternal deaths, but they are not available or they remain inadequate in terms of quality of registration like it normally occurs in most less developed countries.

It is always anticipated that census details are appropriate for generating reliable estimates on maternal mortality in less developed countries. During the 2010 world round of population and housing censuses, questions were included to measure maternal mortality rates. The set of questions included the number of deaths that occurred in the household during the past 12 months. In the case of Timor-Leste, the census data produced reasonable estimates, in spite of the limitations of the data on adult mortality.

Four measures of maternal mortality were estimated: **a)**. Maternal mortality ratio (570 maternal deaths per 100,000 births), **b).** Proportion of deaths due to maternal causes among women in reproductive ages (0.21 or 21%), **c).** Maternal mortality rate (0.97 maternal deaths per 1,000 women) and **d).** The lifetime risk of maternal death (1 in 33.7). These results indicated that maternal mortality was quite high in Timor-Leste. The WHO, UNICEF, UNFPA and the World Bank estimates on maternal mortality for 1990 to 2010 (World Bank, 2012b) indicated that, among the more developed countries the MMR was 16 maternal deaths per 100,000 births; whereas in the less developed countries it was 240.

In a nutshell, maternal mortality rate for Timor-Leste is one of the highest in the world. It is imperative for the Government, civil society and the international community to address this public concern by establishing sound policies and programs to reduce maternal mortality, or strengthen those programs already being implemented.

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CHAPTER 1

INTRODUCTION

1.1 Background

Mortality refers to the deaths that occur in a population. Together with fertility and migration, it is one of the three demographic processes that determine population changes. All people sooner or later die, but the probability of dying at a given age is related to several factors such as age, sex, income, occupation, marital status, among others. Moreover, the level of mortality is one of the best indicators of a population's standard of living and access to health care (Haupt and Kane, 2004; Weeks, 2002).

It was only during the past century that mortality was brought under control. Human victory over many diseases, and especially over infant and child deaths, is one of the major advances ever made in the condition of human life. Although in many countries mortality has declined substantially, there is still room for further improvements.

The two main determinants of mortality decline in the world are socio-economic development as well as medical and public health progress. The former include mainly standard of living increases and better nutrition, but also awareness of personal hygiene, and adoption of adequate health practices. The later comprises the development of preventive and curative technologies to fight diseases; among them, better public sanitation, immunization and the development of crucial therapies (Weeks, 2002; Rowland, 2003).

The decline in mortality in the now developed countries during the 19^{th} century was caused mainly by socio-economic factors. Medical discoveries and public health measures began to gain importance in mortality reduction only in the 20^{th} century when many pandemics of infection had declined substantially. The decline in mortality in the present less developed countries took place especially during the second half of the past century. In these countries the considerable effects of imported medical technologies were even greater through implementation of massive health programs. However, there is a limit to the mortality decline that can be achieved primarily through medical technologies, if socio-economic development remains stagnant (Ruzicka and Hansluwka, 1983). The relationship between socio-economic development improvements in the standard of living, public health programs and access to medical services on one hand and mortality on the other, has been repeatedly established in many studies (see, for example, Vallin and Lopez, 1985).

The process of mortality decline experienced by many countries, and still being experienced by many more, is usually referred to the *epidemiological transition*. This process not only resulted in mortality decline but also in changes in sex and age pattern of disease and mortality. In most countries the entire population has benefited from medical progress and improvements in the standard of living. However, infant and children were the most favored.

1.2. Levels and trends of Mortality in Timor-Leste

During the past decade mortality has experienced a substantial decline in Timor-Leste as it will be shown in this monograph. This was as a result of the slow recovery of the health infrastructure destroyed in the run up to the 1999 Independence referendum[1] as well as the effect of support provided by some bilateral development partners and international agencies. However mortality is far from being low and it needs to be improved considerably to reach an acceptable level.

The main source of mortality data worldwide is the vital registration system. In Timor-Leste, the statistics on birth and death provided by this system, as in other developing countries, are not complete and it is not possible to use them to estimate mortality levels and trends. The main sources of statistics on mortality in Timor-Leste are demographic surveys and censuses. After Independence, two censuses have been conducted in the country, in 2004 and 2010. In addition, two Demographic and Health Surveys (DHS) and one Multiple Indicator Cluster Survey (MICS) have been implemented. This data is therefore enough to establish mortality levels and recent trends. As it occurs in most countries, survey results in Timor-Leste were different from the census results (see Table 2 in Chapter Two). Even the results of the two surveys of the same series (for example, DHS) conducted two different times were not consistent. This is expected because the census considers the entire population, unlike surveys which use samples that often vary from one round of surveys to the other. This difference may also have been caused by the utilization of different data collection instruments (questionnaires) and even the data processing and analysis approaches. Sometimes, different results are magnified because of erroneous interpretations. A major error is to assign the survey or census mortality measure to the same year in which they were conducted. Surveys do not provide measures for the year in which the survey was implemented, but usually for a three or five year period before the date of enumeration. A similar situation occurs with census measures. They are usually for some years before the census takes place.

If the differences between the survey and census results are too large regarding levels of mortality, then it tantamounts to conducting an in-depth examination of the data produced by both the survey and the census.

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[1] Following the resignation of Indonesian President Suharto, a UN-sponsored agreement between Indonesia and Portugal allowed for a UN-supervised popular referendum in August 1999. The resulting clear vote for independence was met with a punitive campaign of violence by Timorese pro-integration militia with the support of elements of the Indonesian military. The majority of the country's infrastructure was destroyed, including homes, irrigation and water supply systems, schools, hospitals and clinics and nearly the country's entire electrical network.

What is important, however, is not to center the discussion on the false expectation of finding the same mortality levels among censuses and surveys, but in the identification of whether a trend is defined by the data. In fact, it is more fruitful to analyze the trend described by the available data from multiple sources than discuss differences that are sometimes quite irrelevant. This issue is considered further in the proceeding sections.

The purpose of this monograph was to estimate and analyze mortality in Timor-Leste according to the 2010 Census. The population and housing census is the more complete source of population data required for administrative purposes, economic and social planning as well as research. It is the only source that provides information for the entire population of the country and not just a sample. A census supplies data to estimate mortality that is not provided by any other source, both to calculate under-five and adult mortality. Therefore, mortality measures based on a population census should be given high consideration in the analysis of mortality.

1.3. Organization of the Monograph

The monograph starts with the background information, mortality levels and trends in the World and in Timor-leste. In chapter two it analyses under-five mortality. A methodological discussion on this topic is presented in an appendix. The chapter ends with an analysis of geographical and socio-economic levels of early age mortality differentials. The third chapter deals with adult mortality. Methodological problems associated with estimation of adult mortality are discussed in an appendix. This chapter concludes with the construction of a complete abbreviated life table for the country. The fourth chapter consists of an analysis of maternal mortality. Special questions to measure this variable were included in the census. It is expected that this monograph will provide a relevant contribution to the analysis of mortality and the improvement of policies directed to reduce it and, in general, provide information to raise the standard of living of the Timorese population. The final chapter five summarizes the conclusions and key recommendations resulting from the findings for policy and program action.

CHAPTER 2

EARLY AGE (CHILD) MORTALITY

2.1. Overview

As mentioned in the previous chapter, infant and child mortality have received substantial attention especially in the less and least developed countries where a substantial number of deaths still occur in early life. Saving children less than 5 years of age, and especially less than 1 year, is a major public health concern, calling for accurate statistics and rigorous measures to identify the extent of the problem and to monitor its progress (Rowland, 2003).

Timor-Leste is not an exception. Shortly after the country gained independence, the Ministry of Health formulated and launched its first National Health Policy Framework (NHPF) for 2002-12. The policy prioritizes the health necessities of the Timorese people and highlights the relevance of understanding the social determinants of health within the local cultural context. The NHFP sought to deliver quality health services for the Timorese by creating and developing a cost-effective and needs-based health system, which would particularly address the health of women, children, and other vulnerable groups, mainly the poor, in a participatory way (Ministry of Health, 2002). The NHPF is the basis for the formulation of other more specific programs such as the National Health Promotion Strategy (NHPS) and the National Reproductive Health Strategy (NRHS) among others.

Because of the importance for understanding early-age mortality, it is essential to mention that fertility in Timor-Leste is still extremely high. According to the 2010 Census, total fertility rate (TFR) was 5.9 children per woman in 2007-2008 (2010 Census in Timor-Leste, Volume 5). According to the DHS, it was 5.7 during the period 2007 to 2010 (National Statistics Directorate, at al. 2010). In the recent past it was even much higher. According to the 2004 Census it was over 7 children per woman.

2.2. Levels and trends of Early Age Mortality

Census estimates of mortality during childhood can be calculated both directly and indirectly. Direct calculation is based on the data produced by a vital registration system. They can be calculated from the number of children under-five years who have died during some reference period (for example, 12 months previous to the census). The number of under-five deaths divided by the number of births, results in the *under-five* or *early-age mortality rate*. Likewise, the reported number of less than one-year children deaths (infant deaths) for a reference period of one year can be divided by the reported births to produce a direct estimate of *infant mortality*. The mortality corresponding to the children 1 to 5 years is called *child mortality* and corresponds to the number of 1 to 5 year old children divided by the number of children surviving to age 1 to 5 years. All these measures can be multiplied by 1,000 to get, for example, the number of infant deaths by 1,000 births (infant mortality rate)

In the less developed countries, vital registration systems are normally incomplete or inexistent. Under-five mortality is typically estimated with the so called *indirect methods*. These methods have been used for more than four decades and results are accurate. These methods are frequently misused, in that the basic assumptions in which they are based are forgotten or there is a limited interpretation of the results that they provide. A poor understanding of the formal demographic structure of the data or the logic of the estimation procedure is not uncommon. For this reason, it was considered important to include an appendix with a discussion of relevant methodological issues regarding these methods. This discussion is presented in Appendix A.

Table 1 presents the results of infant, child and under five mortality from a *Brass-type method*. This approach was developed by William Brass and improved overtime by other researchers. The specific method used here is explained in Appendix A. The result of this method is a series of estimates of infant (less than 1 year) and child mortality (1 to 5 years). Each estimate is dated somewhere between one and fifteen years before the census (United Nations, 1983).

Table 1: Infant, child and under-five mortality rates by sex, 1996 to 2008

Males		Female		Total	
Year	Rate	Year	Rate	Year	Rate
Infant					
2008.5	0.075	2008.4	0.072	2008.5	0.074
2006.8	0.082	2006.8	0.079	2006.8	0.080
2004.8	0.090	2004.7	0.087	2004.8	0.089
2002.5	0.099	2002.4	0.096	2002.5	0.098
1999.9	0.110	1999.9	0.106	1999.9	0.108
1996.9	0.122	1996.9	0.118	1996.9	0.120
Child					
2008.5	0.020	2008.4	0.019	2008.5	0.019
2006.8	0.023	2006.8	0.022	2006.8	0.023
2004.8	0.028	2004.7	0.026	2004.8	0.027
2002.5	0.033	2002.4	0.031	2002.5	0.032
1999.9	0.038	1999.9	0.036	1999.9	0.037
1996.9	0.045	1996.9	0.042	1996.9	0.043
Under-five					
2008.4	0.093	2008.4	0.089	2008.4	0.091
2007.0	0.103	2007.0	0.099	2007.0	0.101
2005.1	0.115	2005.1	0.111	2005.1	0.113
2002.8	0.129	2002.8	0.124	2002.8	0.126
2000.1	0.144	2000.1	0.138	2000.1	0.141
1996.8	0.161	1996.8	0.155	1996.8	0.158

According to Table 1, infant mortality rate is 0.074, which correspond to 74 deaths per 1,000 births. This value indicates a high infant mortality level. In the more developed countries, infant mortality is only 6 deaths per 1,000 births and in the less developed countries the rate is 46. Compared to other countries in the region, Timor-Leste exhibits a higher rate. In Indonesia, Philippines, Myanmar, Thailand and Vietnam, the rates are 25, 21, 45, 11 and 18, respectively (United Nations Population Division, 2011). Regarding child mortality, Timor-Leste exhibits a rate of 19 dead children age 1 to 5 per 1,000 children. This level is higher than that estimated for the developed countries, where the level is just 2, but lower than that estimated for the less developed countries, where the level is 26. Among the previously mentioned countries in the region, only Myanmar has a higher level (28). Indonesia, Philippines, Thailand and Vietnam have lower rates (11, 9, 3 and 7, respectively). The under-five mortality rate is also high at 91; implying that out of every 1,000 children born in Timor-Leste, 91 of them die before celebrating their fifth birthday.

It is also important to analyze early-age mortality trends. However, to validate the accuracy of the estimated trends it is relevant to compare them with values obtained from other sources. Table 3 and Figure 1a and 1b show infant and child mortality rates according to five different sources for a period ranging from 1991 to 2008. Each source provides three measures at different points of time.

The Demographic and Health surveys and Population and Housing censuses show a clear declining trend. It is true that there is a large amount of scatter and the values do not trace a perfect straight line (they indicate different levels in similar years), but the declining tendency is unequivocal. Although the 2009-2010 DHS rates are lower than those estimated from the 2010 Census data, both indicate a declining trend. As mentioned above, one cannot expect the same results between censuses and surveys; not even similar surveys. However, what it is important here is that, this cluster of different measures indicates a declining tendency.

Table 2: Infant and child mortality rates according to several sources, 1984 to 2008

Year	Infant Mortality					Child Mortality				
	MICS 2003	DHS 2003	Census 2004	DHS 2009-10	Census 2010	MICS 2003	DHS 2003	Census 2004	DHS 2009-10	Census 2010
1990										
1991		0.126					0.040			
1992										
1993										
1994										
1995										
1996	0.094	0.108				0.045	0.027			
1997				0.083					0.036	
1998	0.093		0.110			0.044		0.038		
1999										
2000	0.076		0.101			0.033		0.033		
2001		0.060					0.023			
2002			0.098	0.068				0.031	0.032	
2003										
2004					0.089					0.027
2005										
2006					0.080					0.023
2007				0.045					0.020	
2008					0.074					0.019

MICS 2003 = Multiple Indicators Cluster Survey.
DHSs 2003 and 2009-2010 = Demographic and Health Surveys.
Censuses 2004 and 2010

Figure 1a: Infant mortality according to five sources

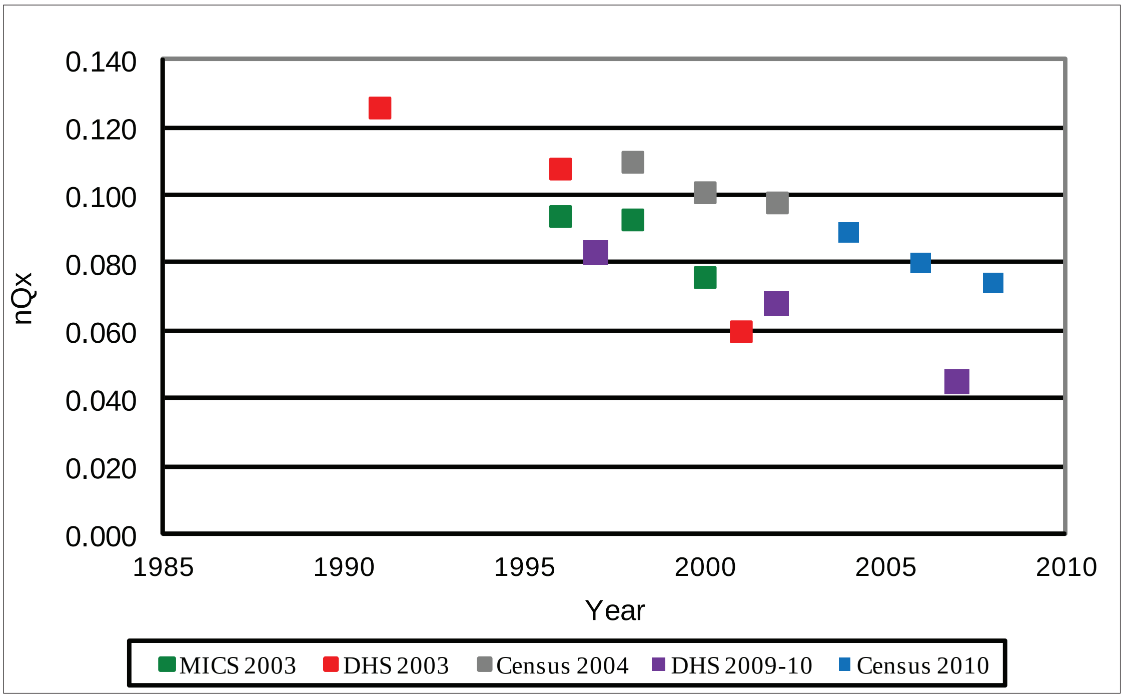
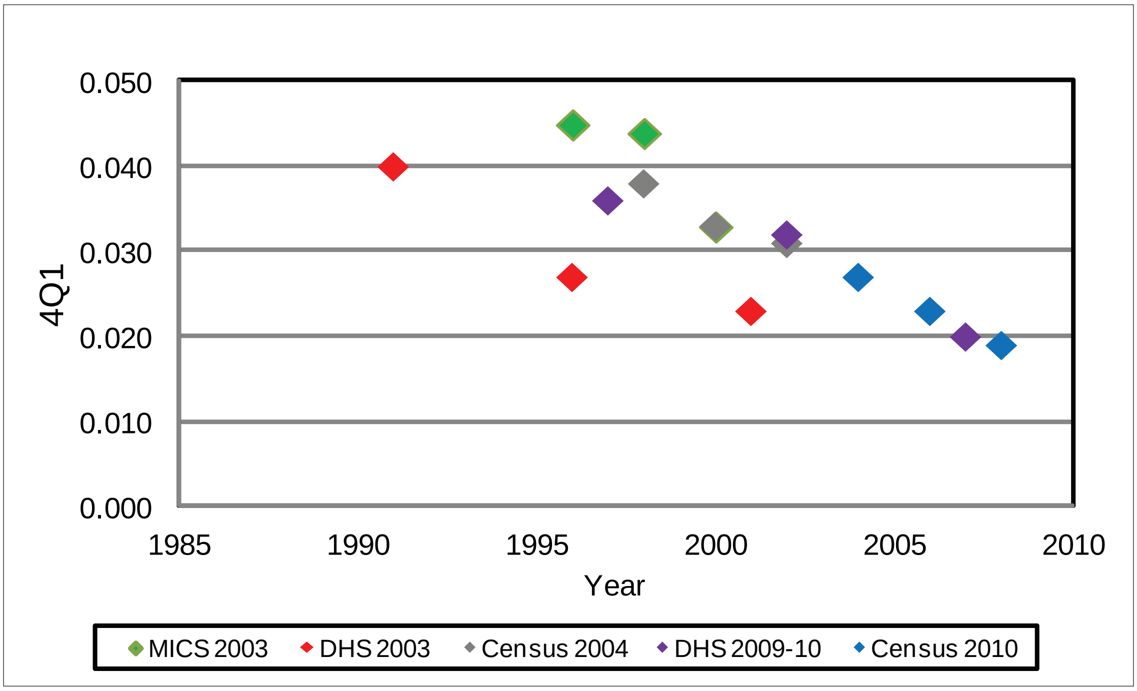


Figure 1b: Child mortality according to five sources



In relation to child mortality, the trend is similar (see Figure 1b). The linear declining tendency is as clear as in the case of infant mortality. The results of the MICS 2003, DHS (2003 and 2009-10) and Censuses 2004 and 2010 delineate an evident linear trend, especially in the most recent years. The data from the 2003 DHS are somehow out of range, but they also follow the declining pattern. The high level of mortality rates evident from the DHS 2003 could have been caused by data only being collected from every married woman and not the entire women population.

Regardless of the source, the decline in infant and child mortality has been substantial in Timor-Leste during recent years. According to the 2010 census under-five mortality has declined by 42 percent in about 10 years and according to the 2009-10 DHS it has declined by 44 percent also in 10 years. This improvement in survival is likely to be attributed to the presence of the *Cuban Medical Brigade* in Timor-Leste, since 2004. Currently, there are about 228 medical doctors, 23 nurses and 40 technicians in the country. They provide services all over the island and also assist in training Timorese health professionals[2]. A technical study should be conducted on the role of this medical assistance and its impact on improving infant and child survival. Available information is mainly from journalists, dissemination or propaganda type.

It is important to note that, census data indicates a decline in child mortality being more rapid than that experienced by infant mortality (56% versus 39%, respectively, according to Table 1). The explanation for this pattern of decline requires additional data and goes beyond the analytical possibilities of this monograph. It suggests the importance of strengthening a health policy directed towards improving the survival of infants such as an expansion and improvement of ante-natal and post-natal care. It would be important to analyze the type of services provided by the *Cuban*

[2] See http://salud.cibercuba.com/node/325, consulted on 30 August 2012.

Medical Brigade in this regard and also compare it with provision of other services, in particular, for older children. The high fertility rates prevailing in the country may also be related to this matter. The analysis of this issue requires additional data; hence, further studies about this topic are also strongly recommended.

2.3. Differentials of Early Age mortality

As mentioned earlier, reducing infant and child mortality is an important public health policy concern. The detailed explanation of changes in these rates remains a continuous pre-occupation of demographic research and theorizing. As suggested in the Introduction, two groups of factors are important in this explanation: *the development of a health infrastructure* (including public health and sanitation programs) and *standard of living of the population* (which include access to food, shelter, education, access to health services, among others). The relationships between these groups of variables and mortality are intricate and not always direct. One initial approach to the analysis of these relationships is by examination of *mortality differentials*, that is, by comparing the early-age mortality rates corresponding to different relevant population groups[3]. This section presents and analyzes selected infant and child mortality differentials.

Table 3 shows selected differentials of infant and child mortality. They are presented for 3 dates (2008-09, 2006-07 and 2004-05) and by sex[4]. The same indirect technique and approach used to estimate the rates at the national level were utilized to estimate these differentials[5].

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3 A differential is not a determinant or a cause. A differential, as mentioned above is just a variable that identifies attributes, classes or categories of infant and children that are likely to have different mortality rates. Such differences, however, usually gives clues regarding determinants or, in other words, suggest causal relationships.

4 It is relevant to remember that the values presented in Table 3 refers to the probability of dying. If infant mortality is multiplied by 1,000 it gives the number of infant deaths per 1,000 births (during the respective year) and child mortality multiplied by 1,000 indicates the number of deaths in children 1-4 years old per 1,000 children surviving to age 12 months For analytical reasons, the probabilities of dying are a more convenient way to express under-five mortality rates.

5 It is important to point out that when applied to population sub-groups, Brass-type methods do not always provide accurate and reliable estimates of under-5 mortality. The main problem is the violation of key assumptions. However, in general, they produce approximate estimates that usually allow relevant analyses. In this case, estimates appear to be reliable enough to draw relevant and consistent conclusions. Differentials are as expected, that is, in line with general theoretical proposition and are similar to differentials found in other countries. In addition, Table 3 includes the percentage of children ever born who have died as declared by women 20-34 years old. This can be considered a direct crude measure of early-age mortality, but it appears adequate to provide a gross validation of the levels of early-age mortality in the groups defined by the variables considered in Table 3.

Table 3: Selected infant, child and under-five mortality differential, 2008-2009 to 2004-2005

Variable and sex	Infant mortality			Child mortality			Under-five Mortality			Percentage of death children from women 20 to 34 years old
	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	
Timor-Leste	0.074	0.080	0.089	0.019	0.023	0.027	0.091	0.101	0.103	10.0
Male	0.075	0.082	0.090	0.020	0.023	0.028	0.093	0.103	0.115	10.1
Female	0.072	0.079	0.087	0.019	0.022	0.026	0.089	0.099	0.111	9.8
Urban-Rural										
Urban	0.062	0.067	0.073	0.014	0.016	0.019	0.075	0.082	0.091	8.0
Male	0.062	0.067	0.073	0.014	0.016	0.019	0.075	0.082	0.091	8.1
Female	0.061	0.066	0.072	0.013	0.016	0.019	0.073	0.081	0.090	7.9
Rural	0.079	0.086	0.094	0.021	0.025	0.030	0.098	0.108	0.121	10.8
Male	0.080	0.087	0.096	0.034	0.026	0.031	0.112	0.111	0.124	11.0
Female	0.077	0.084	0.092	0.020	0.024	0.028	0.095	0.105	0.118	10.6
District										
Ainaro	0.076	0.084	0.094	0.019	0.024	0.029	0.094	0.106	0.121	10.9
Male	0.080	0.087	0.097	0.022	0.026	0.031	0.100	0.111	0.125	11.2
Female	0.072	0.080	0.091	0.017	0.022	0.028	0.087	0.101	0.116	10.6
Aileu	0.066	0.073	0.081	0.015	0.019	0.023	0.080	0.091	0.102	9.6
Male	0.068	0.075	0.084	0.016	0.019	0.024	0.083	0.093	0.106	9.8
Female	0.063	0.070	0.079	0.014	0.018	0.022	0.076	0.087	0.099	9.3

Continued

Table 3: Selected infant, child and under-five mortality differential, 2008-2009 to 2004-2005

Variable and sex	Infant mortality			Child mortality			Under-five Mortality			Percentage of death children from women 20 to 34 years old
	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	
Baucau	0.079	0.087	0.096	0.021	0.025	0.031	0.098	0.110	0.124	11.2
Male	0.079	0.087	0.098	0.021	0.025	0.031	0.098	0.110	0.126	11.5
Female	0.079	0.086	0.095	0.021	0.025	0.030	0.098	0.109	0.122	11.4
Bobonaro	0.088	0.093	0.100	0.026	0.029	0.033	0.112	0.119	0.130	11.9
Male	0.088	0.094	0.102	0.026	0.030	0.034	0.112	0.121	0.133	11.6
Female	0.088	0.093	0.099	0.026	0.029	0.032	0.112	0.119	0.128	12.1
Covalima	0.071	0.080	0.091	0.018	0.022	0.028	0.088	0.100	0.116	10.5
Male	0.074	0.083	0.093	0.019	0.024	0.029	0.092	0.105	0.119	10.6
Female	0.068	0.077	0.088	0.016	0.021	0.027	0.083	0.096	0.113	10.4
							0.000	0.000	0.000	
Dili	0.059	0.064	0.070	0.013	0.015	0.018	0.071	0.078	0.087	7.5
Male	0.060	0.065	0.071	0.013	0.015	0.018	0.072	0.079	0.088	7.6
Female	0.057	0.062	0.069	0.012	0.015	0.017	0.068	0.076	0.085	7.3
Ermera	0.093	0.099	0.106	0.029	0.032	0.036	0.119	0.128	0.138	12.1
Male	0.097	0.102	0.109	0.031	0.034	0.037	0.125	0.133	0.142	12.6
Female	0.090	0.096	0.103	0.027	0.030	0.034	0.115	0.123	0.133	11.6

Continued

Table 3: Selected infant, child and under-five mortality differential, 2008-2009 to 2004-2005

Variable and sex	Infant mortality			Child mortality			Under-five Mortality			Percentage of death children from women 20 to 34 years old
	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	
Liquica	0.070	0.076	0.086	0.018	0.021	0.024	0.087	0.095	0.108	9.6
Male	0.075	0.078	0.082	0.021	0.023	0.026	0.094	0.099	0.106	10.3
Female	0.064	0.071	0.079	0.015	0.018	0.022	0.078	0.088	0.099	8.9
Lautem	0.065	0.072	0.081	0.015	0.019	0.023	0.079	0.090	0.102	9.2
Male	0.068	0.076	0.085	0.016	0.020	0.025	0.083	0.094	0.108	9.5
Female	0.061	0.069	0.077	0.013	0.017	0.022	0.073	0.085	0.097	8.8
Manufahi	0.066	0.073	0.083	0.015	0.019	0.024	0.080	0.091	0.105	9.2
Male	0.068	0.075	0.085	0.016	0.020	0.025	0.083	0.094	0.108	9.4
Female	0.063	0.071	0.081	0.014	0.018	0.023	0.076	0.088	0.102	9.0
Manatuto	0.073	0.080	0.089	0.019	0.023	0.027	0.091	0.101	0.114	9.9
Male	0.071	0.079	0.088	0.018	0.022	0.026	0.088	0.099	0.112	9.9
Female	0.075	0.082	0.089	0.020	0.023	0.027	0.094	0.103	0.114	9.9
Oecussi	0.074	0.078	0.082	0.019	0.021	0.024	0.092	0.097	0.104	9.3
Male	0.075	0.079	0.084	0.020	0.022	0.024	0.094	0.099	0.106	9.5
Female	0.072	0.076	0.081	0.019	0.021	0.023	0.090	0.095	0.102	9.2
Viqueque	0.080	0.088	0.098	0.021	0.026	0.031	0.099	0.112	0.126	11.3
Male	0.074	0.084	0.096	0.018	0.023	0.030	0.091	0.105	0.123	11.6
Female	0.085	0.092	0.100	0.024	0.028	0.033	0.107	0.117	0.130	11.0

Continued

Table 3: Selected infant, child and under-five mortality differential, 2008-2009 to 2004-2005

Variable and sex	Infant mortality			Child mortality			Under-five Mortality			Percentage of death children from women 20 to 34 years old
	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	
Literacy										
Literate	0.069	0.073	0.077	0.018	0.019	0.021	0.086	0.091	0.096	8.7
Male	0.070	0.073	0.078	0.018	0.020	0.022	0.087	0.092	0.098	8.8
Female	0.069	0.072	0.077	0.017	0.019	0.021	0.085	0.090	0.096	8.6
Illiterate	0.089	0.095	0.103	0.026	0.030	0.033	0.113	0.122	0.133	12.2
Male	0.090	0.096	0.104	0.028	0.031	0.035	0.115	0.124	0.135	12.3
Female	0.088	0.095	0.102	0.027	0.029	0.034	0.113	0.121	0.133	12.2
Educational Level										
No education	0.084	0.087	0.089	0.024	0.027	0.028	0.106	0.112	0.115	10.7
Male	0.085	0.088	0.090	0.025	0.028	0.030	0.108	0.114	0.117	11.2
Female	0.083	0.086	0.088	0.023	0.025	0.027	0.104	0.109	0.113	10.2
Primary and non formal	0.082	0.084	0.090	0.022	0.024	0.026	0.102	0.106	0.114	10.4
Male	0.083	0.086	0.091	0.023	0.025	0.028	0.104	0.109	0.116	10.7
Female	0.080	0.083	0.089	0.021	0.023	0.025	0.099	0.104	0.112	10.1
Pre-secondary	0.073	0.075	0.077	0.019	0.020	0.021	0.091	0.094	0.096	8.8
Male	0.074	0.076	0.078	0.019	0.020	0.021	0.092	0.094	0.097	8.9
Female	0.071	0.074	0.077	0.018	0.020	0.021	0.088	0.093	0.096	8.6

Continued

Table 3: Selected infant, child and under-five mortality differential, 2008-2009 to 2004-2005

Variable and sex	Infant mortality			Child mortality			Under-five Mortality			Percentage of death children from women 20 to 34 years old
	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	
Secondary and over	0.060	0.062	0.065	0.013	0.015	0.017	0.072	0.076	0.081	7.6
Male	0.061	0.064	0.067	0.014	0.015	0.017	0.074	0.078	0.083	7.7
Female	0.059	0.060	0.062	0.012	0.014	0.016	0.070	0.073	0.077	7.5
Type of floor										
Wood, tiles, concrete	0.065	0.070	0.077	0.015	0.018	0.021	0.079	0.087	0.096	8.5
Male	0.067	0.072	0.078	0.016	0.019	0.022	0.082	0.090	0.098	8.7
Female	0.062	0.068	0.075	0.014	0.017	0.020	0.075	0.084	0.094	8.3
Soil and other	0.079	0.086	0.095	0.049	0.055	0.061	0.124	0.136	0.150	10.9
Male	0.080	0.088	0.097	0.021	0.026	0.031	0.099	0.112	0.125	11.0
Female	0.078	0.085	0.093	0.078	0.085	0.093	0.150	0.163	0.177	10.7
Source of water										
Probably safe	0.072	0.078	0.086	0.018	0.021	0.025	0.089	0.097	0.109	9.7
Male	0.073	0.080	0.087	0.019	0.022	0.026	0.091	0.100	0.111	9.8
Female	0.070	0.077	0.084	0.017	0.020	0.024	0.086	0.095	0.106	9.6
Probably unsafe	0.077	0.084	0.093	0.020	0.024	0.029	0.095	0.106	0.119	10.8
Male	0.079	0.086	0.095	0.021	0.025	0.030	0.098	0.109	0.122	10.2
Female	0.074	0.082	0.091	0.019	0.023	0.028	0.092	0.103	0.116	10.5

Continued

Table 3: Selected infant, child and under-five mortality differential, 2008-2009 to 2004-2005

Variable and sex	Infant mortality			Child mortality			Under-five Mortality			Percentage of death children from women 20 to 34 years old
	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	2008-09	2006-07	2004-05	
Sewage disposal										
Hygienically safe	0.066	0.071	0.078	0.016	0.018	0.022	0.081	0.088	0.098	8.6
Male	0.067	0.072	0.079	0.016	0.019	0.022	0.082	0.090	0.099	8.7
Female	0.064	0.070	0.076	0.015	0.018	0.021	0.078	0.087	0.095	8.5
Hygienically unsafe	0.080	0.088	0.097	0.022	0.026	0.031	0.100	0.112	0.125	11.1
Male	0.082	0.089	0.099	0.022	0.027	0.032	0.102	0.114	0.128	11.3
Female	0.078	0.086	0.094	0.021	0.025	0.030	0.097	0.109	0.121	10.9
Source of water:										
Probably safe =	Pipe or pump indoors or outdoors, public tap, protected well or spring, bottle water, and water vendor/tank.									
Probably unsafe =	Tube well/borehole, rainwater collection, non protected well or spring, river, lake and other.									
Sewage disposal:										
Hygienically safe=	Pit latrine with slab, ventilated improved pit latrine, pour flush to pit tank/pit, pour flush to elsewhere/DK.									
Hygienically safe=	Pit latrine without slab/open pit, hanging toilet/latrine, no facility or bush									

The first panel in Table 3 shows the estimates of infant and child mortality at the national level. This is the same data presented in Tables 1and 2. It was included for the sake of comparison. It is also important to discuss the sex differentials, which has not been analyzed in previous sections.

In all countries, at every age there are differences between males and females in the likelihood of death. Some of these differences appear to be strictly biological (sex differences) whereas others are induced by society (gender differences). In countries where women have a substantial lower status than men, there is a marked preference for boys, thus girls have lower probability of surviving than boys (Vallin, 2006; Weeks, 2002).

In general, survival probabilities of infant girls are higher than those corresponding to infant boys (except in countries where the status of women is extremely low).There appears to be an innate tendency for infant girls to better resist the force of mortality. Some demographers consider that it is biologically determined in order to equilibrate the sex ratio at birth which is in favor of males (it is usually between 103 to 107 baby boys per 100 baby girls, see Hobbs, 2004).

Infant mortality rates are slightly higher among boys than among girls in Timor-Leste. Child mortality is also a little higher among males, but differences are almost negligible. Note that the percentage of death for boys from women 20 to 34 years old is somewhat higher than the percentage of death for girls. Regarding the decline, both sexes have dropped almost at the same pace during the period considered in Table 4, approximately by 16 percent. As in most less developed societies, there is a high preference for boys in Timor-Leste. However, these data suggest that sex preferences are not strong enough to affect under-five mortality.

The second panel in Table 3 shows the urban-rural differentials. They refer to the places of residence for women during the census enumeration. The most recent infant mortality estimates (2008-09) in urban areas was 0.062 while in rural areas it was 0.079. Previous years 'differences were also important as sources of reference. Sex differences were small; likewise, survival rates tended to favour infant girls. Regarding child mortality, urban-rural differences were also substantial: 0.014 in urban areas and 0.021 in rural areas in 2008-09. The percentage of death for children from 20 to 34 years old women was also greater in rural areas. In both urban and rural areas there was improvement in infant and child survival during the period covered in the analysis (a decline of about 15% in both cases). Male and female differences were irrelevant. In summary, the probabilities of dying in urban areas were lower for both infant and children than in rural areas.

This is a clear reminder that health infrastructure and socio-economic factors can have a major impact on human wellbeing. Urban and rural areas differed substantially regardless of these groups of variables. Examples are piped clean water, piped sewerage system, transport and communication systems that deliver food and other goods and a health care system that is affordable and available (Weeks, 2002). Urban and rural areas may vary substantially in their ability to access these resources. This appears to be the case in Timor-Leste. Medical advances and environmental improvements have favored the urban areas more than the rural population.

Nevertheless, it is important to take into consideration that, improvements in survival rates were similar during recent years in both urban and rural areas. The data suggested that the socio-economic situation of the population in rural areas had improved and/or that availability and access to medical services had increased. The period under consideration in Table 3 (just 4 years) is too short to assume major changes in the socio-economic situation of rural areas in Timor-Leste and, even if improvements had taken place, it is too short a period to expect progress in children survival. Better access to medical services and campaigns are more likely. This improvement could probably be related to the work of the *Cuban Medical Brigade* in Timor-Leste as previously mentioned. The activities of Cuban health professional are spread all over the country and not concentrated in urban areas.

The third panel in Table 3 shows differences among the districts in which the country is administratively divided. The explanation of differences among sub-areas in a country follows the same logic of the urban-rural differentials. Some sub-areas may have a higher degree of development, better standard of living and health infrastructure, which affects the health of the mother and her children.

There are five districts where infant mortality rates are higher than the national rate: Ainaro, Baucau, Bobonaro,Ermera and Viqueque. On the other hand, there are eight districts (out of 12 plus Dili) that exhibit infant mortality rates below the national rate (0.074): Aileu, Covalima, Dili, Liquica, Lautem, Manufahi,Manatuto and Oecusse. The lowest rate corresponds to the capital city Dili (0.059) and the highest to Ermera (0.093).

To what extent is the difference in infant mortality among districts consistent with differences in the degree of socio-economic development of the districts? This question is not only important because of its evident relevance, but also because it may help to validate the estimates of infant mortality at the district level. The correlation coefficient between infant mortality rate and percentage literacy was calculated at the district level. Literacy is a valid indicator of the socio-economic development level of the district. The correlation coefficient was -0.72, which implies that literacy is negatively related to infant mortality[6]. Those districts with a high percentage of literacy have, in general, exhibited lower infant mortality rates than those with a smaller percentage of literacy. The value of the correlation coefficient is far from indicating a perfect linear relationship, but it certainly indicated a clear and strong association between the two variables, which was the expected outcome[7].

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6 The correlation coefficient varies from +1.00 to -1.00, with 0.00 indicating a lack of relationship between the variables; +1.00 designates a perfect direct linear relationship and -1.00 a perfect negative relationship.

7 It is interesting to mention that when this relationship is calculated using the infant mortality rates estimated by the 2009-10 DHS, the correlation coefficient is only -0.37. Such a weak relationship is not expected between these two variables and, therefore, infant mortality estimates at the district level according to the DHS may have consistency problems.

In general, males exhibited higher infant mortality rates than females. The exceptions were in Manatuto and Viqueque districts, where males had lower probabilities of dying than females. In Baucau and Bobonaro districts there were no differences. In the other districts differences were relatively moderate, except in Ainaro and Liquica where they were larger.

The decline during the period under consideration was substantial in most districts, while in others it was moderate. For example, in Covalima and Manufahi the decline was over 20% while in Bobonaro and Ermerait was about 12%. In some cases the decline favored infant boys more than the girls such as in Baucau, Bobonaro, Manatuto and Viqueque. On the contrary, girls experienced a larger decline than boys in the other districts. In Liquica the decline among baby girls was two times that of baby boys. However, in all districts mortality experienced an evident decline.

Child mortality experienced a similar behavior compared to infant mortality. There were substantial variations among the districts. Rates varied from 0.013 in Dili to 0.029 in Ermera. Male children, in general had lower survival probabilities than female children, except in Manatuto and Viqueque. There were no sex differences in Baucau and Bobonaro districts. Regarding child mortality decline, there were also variations between sexes, in some districts favoring females while in others males; however, differences were not as important as in the case of infant mortality.

It is important to note that these results have to be interpreted with caution considering that they were estimated with a method that could have produced unreliable estimates. As mentioned above, the main problem was the violation of some of the assumptions in which the method was based. Nevertheless, the percentage of children ever born and who had died from women 20 to 34 was consistent with the indirect estimates. The correlation coefficient, that measured the degree of relationship between the two variables, was calculated between the most recent estimates of infant mortality and the percentage of dead children (totals) and the result was 0.93. The correlation coefficient between the most recent estimates of child mortality and the percentage of dead children was 0.89. To some extent these results validate the values of the indirect estimates in the districts and suggest that they can be considered as relatively reliable.

It is also relevant to remember that the period under consideration in Table 3 was quite short, so changes in under-five mortality have to be interpreted with caution. Furthermore, changes indicated by the method may not be reliable; only an artifact of the methodology. Nevertheless, the results seemed consistent with what was expected.

Being a small country (14,874 sq. km), smaller spatial differentials could be expected. *Timor-Leste is a country with substantial sub-national differences in development, poor communications and a diversity of ethnic groups with different cultures (Molnar, 2010)*. Comprehensive studies about under-five mortality differentials and research at the individual or household level using, for example, multivariate analysis, should be conducted in order to explore and explain these sub-national differences. In any case, the results presented in this simple analysis are quite relevant in terms of policy and program formulation, in particular to focus on health measures and actions to the less favored sub-national areas.

The fourth and fifth panel in Table 3 shows two variables referring to education of women. One is literacy and the other educational level of mothers. According to the relevant literature, infants or children born from literate mothers are more likely to survive than children born from illiterate mothers. In many countries, children who are born from mothers with primary education exhibit lower mortality rates than children born from woman with no education at all, but higher rates than children born from women with complete secondary education (Hull and Jones. 1986). This is precisely the case in Timor-Leste.

According to Table 3, the probability of dying for an infant born from an illiterate mother was higher than the probability corresponding to an infant born from a literate mother. Sex differences were small between both, literate and illiterate mothers, but in all cases rates were a little higher for male children. During the 4 years under consideration, the mortality decline of infants from illiterate mothers was a little larger than that of infants from literate mothers (13% against 10%, respectively). Sex differentials in the decline were almost negligible. Child mortality exhibited the same patterns as infant mortality.

Table 3 also indicates that differences in the educational level of mothers affected the survival probability of children. As the educational level of women increased, infant mortality rates decreased. The same patterns were observed when child mortality was considered. Mother's education is an important differential because it is related to her capacity to raise a healthy child which is, in turn, the result of her capability to use a health facility and modern medicines, to her knowledge of adequate practices to maintain her own and her children health and to reject harmful traditional practices related to health and diseases (Caldwell, 1979; Mosley and Chen 1984).

This relationship between mother's education and early-age mortality is quite clear in Table 3. Sex differentials followed the expected pattern (a little higher rate for boys than for girls). No major sex differences were observed regarding the decline. In other words, the patterns were consistent with those observed among the total population.

Another important set of differentials that helped to clarify under-five mortality were differentials regarding characteristics of the housing unit where the mother and infant or child resided. In this study, three housing unit characteristics were considered: **material of the floor in the dwelling, water supply and sewage disposal.**

The material of the floor of main dwellings is not only an indicator of the economic situation of the household that occupies such dwelling, but also of the hygienic conditions of the immediate environment where the infant or child lived. In a dwelling with soil floor an infant or child is more exposed to infections than in a house with a floor made of wood, tiles, bricks, or even cement. Therefore, it is expected to have higher infant and child mortality rates in housing units with soil floors.

In fact, according to Table 3, children born in dwellings with constructed floors (tiles, wood, and cement) had better survival chances than children born in houses with soil floors. This pattern applied to both male and female infants and children. The rates were perfectly consistent with the percentages.

Dwelling's type of water was also related to infant and child mortality, although the differences were smaller compared to housing unit characteristics. The reason for this modest difference was the contamination of the sources that were defined as hygienically secure (tap water, piped indoors or outdoors, protected well/spring and bottled water).It is likely that the hygienic quality of these sources was only marginally better than the other sources (tube well, rainwater collection, non-protected well/spring, water vendor, lake/stream and other) and, therefore, its effect on under-five survival was of more limited relevance than other dwelling characteristics.

Finally, Table 3 shows the difference between the type of sewage disposal and infant and child mortality. Infants and children living in dwellings with hygienically safe disposal (ventilated improved pit latrine, pour/flush to skeptical tank/pit or elsewhere) had much better survival chances than children living in dwellings with unsafe disposal (pit latrine without slab/open pit, hanging toilet/ latrine, not facility or bush, other). As in the case of other differentials, sex differences favored boys although differences with girls were small. A decline in infant rates was also observed among both boys and girls. This decline was almost negligible in the case of child mortality.

It is important to remember that these three dwelling characteristics appeared to be related to the socio-economic status of families and their vulnerability, and probably to the education level of their mothers. Therefore, they seemed to affect infant mortality not only by a direct effect but also because they were related with other factors that affected under-five mortality.

There was an important finding revealed by these data that is worthy to emphasize. Infant mortality rates were high in all the groups or categories established by the variables considered in the differential analysis. Obviously, infants born from mothers in a given category had more possibilities to survive than those born from mothers in other groups, but regardless of the category, the rates were quite high. As a point of comparison, considering the infant mortality rate estimated for the less developed countries (46 deaths per 1,000 births); in all the categories Infant mortality rate was higher than 0.046 (see Table 3). This fact should be given special attention for future research[8].

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8 It is also important to bear in mind that the application of the Brass-type of indirect methods to the analysis of mortality differentials is not always satisfactory and several biases may result. However, the technique is robust enough to give, if not precise results, an acceptable estimate of the mortality experienced by the group of infant and children defined by the differentials. A good way to validate the result is to examine whether the result follow the expected pattern, that is, a result often observed in other countries or contexts. In the case of this analysis of differential, all cases follow approximate results.

CHAPTER 3

ADULT MORTALITY AND LIFE TABLES

3.1. Overview

The measurement of adult mortality is as equally important as that of early age mortality in a population. It is known that due to a substantial number of infant and child deaths still occurring in less developed countries, the measurement of early age mortality has received a lot of attention in the mortality literature. Similary, adult mortality is also equally relevant. The ageing population in both the more and less developed countries, with the associated increasing share of mortality that occurs in adulthood, has accentuated the need to obtain better estimates of mortality at adult age. It is also important to remember that the construction of accurate life tables, which are one of the most powerful instruments used to analyze mortality, require reliable adult mortality data (Kintner, 2004).

In the more developed countries, adult mortality can be measured using data from civil registration systems and population numbers derived from censuses or population registers. In most less developed countries, however, the estimation of adult mortality is seriously constrained by the absence of reliable, continuous, and complete data from the registration systems. The most frequent approach was to use data from censuses or household based surveys. Several indirect methods have been developed during recent decades to measure adult mortality from these data sources or to adjust vital registration information.

The utilization of a question on the number of deaths in a household during the preceding 12 months became quite common during the 2000 and 2010 world round of population and housing censuses. This question allows a direct calculation of mortality. Nevertheless, results exhibited several mistakes, mainly in under-enumeration of deaths. There are several methods used to assess and correct the data from this problem and frequently adjust the results successfully (United Nations, 1983; Statistical Institute for Asia and the Pacific, 1994; Hill et all, 2001).

3.2. Life expectancy

The question on deaths in households during the preceding past 12 months was incorporated in the Timor-Leste 2010 Census. Sex and age of the dead were as also included. The evaluation of the data as well as the method used in this monograph to estimate adult mortality and to elaborate life tables is presented in Appendix B. The final products are life tables by sex. These life tables are presented in Table 4. A graph containing the survivorships from the life tables for males and females was presented in Figure 2.

Table 4: Life Tables, 2008-2009

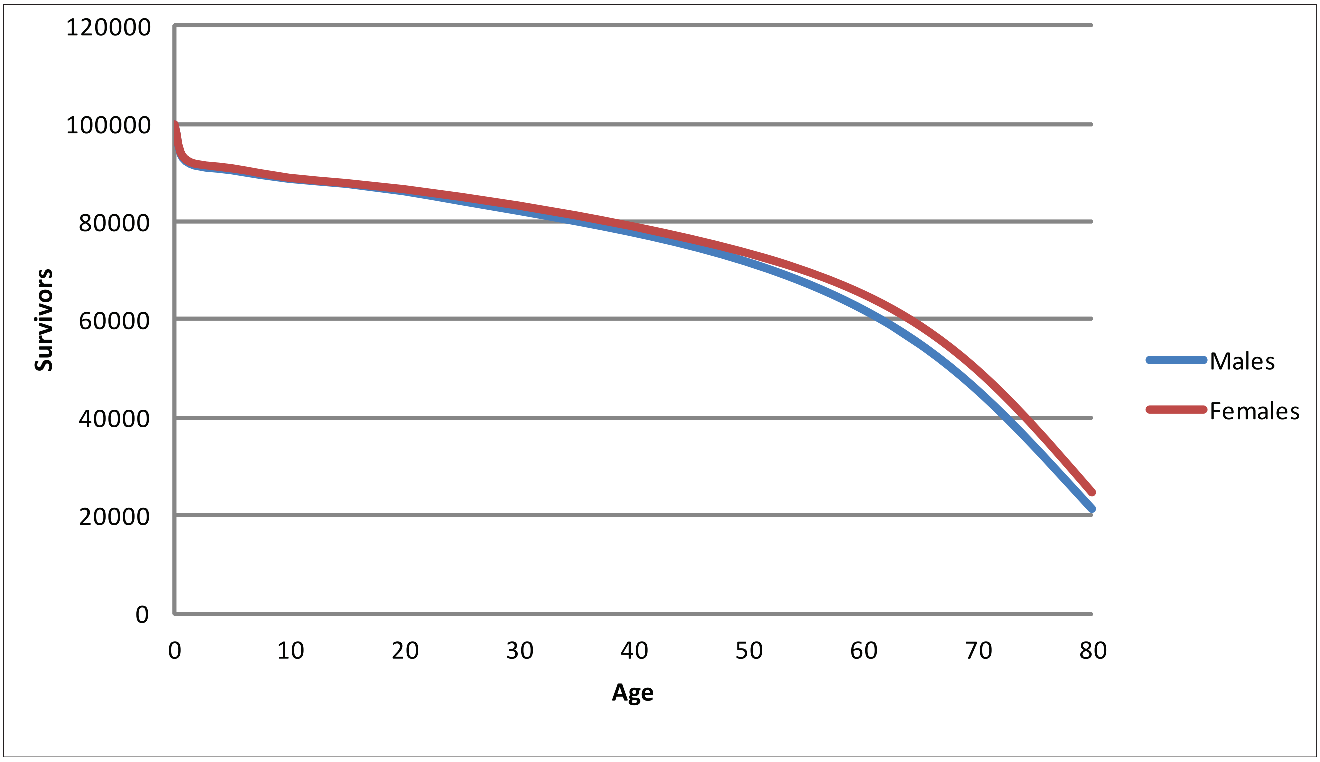
Males									
Age	m(x,n)	q(x,n)	l(x)	d(x,n)	L(x,n)	S(x,n)	T(x)	e(x)	a(x,n)
0	0.080	0.075	100000	7515	94428	0.919	5871662	58.72	0.26
1	0.005	0.020	92485	1824	365246	0.977	5777234	62.47	1.43
5	0.004	0.019	90661	1756	448916	0.984	5411987	59.69	2.50
10	0.002	0.012	88905	1029	441955	0.986	4963072	55.82	2.50
15	0.003	0.017	87877	1506	435824	0.980	4521117	51.45	2.64
20	0.005	0.023	86370	1985	427009	0.976	4085292	47.30	2.56
25	0.005	0.024	84385	2016	416914	0.975	3658284	43.35	2.51
30	0.005	0.026	82370	2111	406632	0.973	3241370	39.35	2.53
35	0.006	0.029	80259	2314	395633	0.968	2834738	35.32	2.55
40	0.007	0.035	77944	2730	383094	0.961	2439105	31.29	2.57
45	0.009	0.043	75214	3271	368209	0.949	2056011	27.34	2.60
50	0.012	0.060	71944	4312	349375	0.931	1687802	23.46	2.60
55	0.016	0.079	67632	5315	325439	0.905	1338427	19.79	2.61
60	0.024	0.115	62316	7156	294544	0.860	1012988	16.26	2.62
65	0.037	0.170	55160	9354	253382	0.793	718444	13.02	2.60
70	0.058	0.253	45806	11590	200842	0.694	465062	10.15	2.57
75	0.091	0.371	34216	12682	139358	0.473	264219	7.72	2.50
80	0.172	...	21535	21535	124862	...	124862	5.80	5.80
Females									
Age	m(x,n)	q(x,n)	l(x)	d(x,n)	L(x,n)	S(x,n)	T(x)	e(x)	a(x,n)
0	0.076	0.072	100000	7205	94713	0.923	6035121	60.35	0.27
1	0.005	0.019	92795	1723	366712	0.976	5940409	64.02	1.41
5	0.004	0.021	91072	1954	450476	0.983	5573697	61.20	2.50
10	0.002	0.012	89118	1087	442873	0.987	5123221	57.49	2.50
15	0.003	0.014	88031	1251	437124	0.984	4680347	53.17	2.58
20	0.004	0.018	86780	1571	430090	0.980	4243223	48.90	2.57
25	0.004	0.021	85209	1787	421666	0.978	3813133	44.75	2.55
30	0.005	0.024	83422	1996	412212	0.974	3391466	40.65	2.55
35	0.006	0.028	81425	2243	401643	0.970	2979255	36.59	2.55
40	0.007	0.033	79183	2597	389553	0.965	2577612	32.55	2.55
45	0.008	0.038	76585	2873	375954	0.957	2188059	28.57	2.57
50	0.010	0.050	73713	3671	359758	0.943	1812104	24.58	2.60
55	0.014	0.067	70042	4667	339103	0.919	1452346	20.74	2.62
60	0.021	0.100	65374	6508	311507	0.876	1113244	17.03	2.64
65	0.033	0.153	58866	9031	272890	0.809	801737	13.62	2.63
70	0.053	0.236	49835	11748	220793	0.713	528847	10.61	2.58
75	0.084	0.349	38087	13286	157474	0.489	308054	8.09	2.52
80	0.165	...	24801	24801	150580	...	150580	6.07	6.07

Continued

Total									
Age	m(x,n)	q(x,n)	l(x)	d(x,n)	L(x,n)	S(x,n)	T(x)	e(x)	a(x,n)
0	0.078	0.073	100000	7346	94346	0.921	5948062	59.48	0.23
1	0.005	0.019	92654	1775	365944	0.977	5853716	63.18	1.37
5	0.004	0.020	90879	1853	449764	0.984	5487771	60.39	2.50
10	0.002	0.012	89026	1058	442488	0.986	5038007	56.59	2.50
15	0.003	0.016	87969	1379	436396	0.982	4595519	52.24	2.50
20	0.004	0.021	86590	1783	428493	0.978	4159123	48.03	2.50
25	0.005	0.022	84807	1904	419277	0.976	3730630	43.99	2.50
30	0.005	0.025	82904	2055	409381	0.974	3311353	39.94	2.50
35	0.006	0.028	80849	2280	398544	0.969	2901972	35.89	2.50
40	0.007	0.034	78569	2665	386183	0.963	2503428	31.86	2.50
45	0.008	0.041	75904	3075	371834	0.952	2117245	27.89	2.50
50	0.011	0.055	72829	3998	354150	0.936	1745411	23.97	2.50
55	0.015	0.073	68831	4998	331659	0.911	1391261	20.21	2.50
60	0.023	0.107	63833	6836	302074	0.867	1059602	16.60	2.50
65	0.035	0.161	56997	9182	262030	0.801	757528	13.29	2.50
70	0.056	0.244	47815	11652	209946	0.706	495498	10.36	2.50
75	0.088	0.360	36163	13012	148286	0.481	285551	7.90	2.50
80	0.169	...	23151	23151	137265	...	137265	5.93	5.93

First entry of S(x,n) is for survivorship of 5 cohorts of birth to age group 0-4 = L(0,5) / 500000
Second entry of S(x,n) is for S(0,5) = L(5,5) / L(0,5)
Last entry of S(x,n) is S(75+,5) = T(80) / T(75)

Figure 2: Number of survivors (lx) by sex, 2008-2009



According to the approach presented in Appendix B, life expectancies are 58.72 years for males, 60.35 years for females and 59.48 years for both sexes combined. These values are more credible than those obtained with other methods. These life expectancies at birth correspond approximately for 2008-2009. The gain with respect to the values estimated from the 2004 census is 1.32 and 1.45 years for males and females, respectively.

Much more progress regarding mortality decline must take place in Timor-Leste. It is still the country with the lowest life expectancy in South East Asia. For example, according to estimates from the United Nations Population Division (2011) for the period 2005-10, in the Philippines, life expectancy at birth for males was 64.54 years and for females 71.20 years. In Myanmar, these values were 62.08 and 64.98 years, respectively. In Thailand, Vietnam and Indonesia male life expectancy at birth was 70.17, 72.33 and 66.29 years, respectively; female values were 77.06, 76.21 and 69.43 years. The average life expectancy at birth among the more developed countries was 73.41 year for males and 80.42 years for females while in the less developed countries they were 64.24 and 67.77 years, respectively. These values are far from those estimated for Timor-Leste: 58.72 years for males and 60.35 for females[9].

In the vast majority of countries life expectancy at birth is greater among females. The reason is that women live longer than males because of a combination of biological and behavioral differences. Men generally smoke tobacco and drink alcohol more than women. They have more motor vehicle accidents, engage in more dangerous occupations and are more prone to suicide. A large proportion of male excess mortality is caused by ischemic heart diseases and lung cancer, both of which are related to life style. Males have also great susceptibility to life-threatening diseases. Female hormones provide defenses from coronary artery/ischemic heart diseases until menopause, causing a ten year deferral compared with males, in the onset of heightened of risk of death for this cause (Rowland, 2003).

Life tables, and in particular life expectancy at birth, combines early-age and adult mortality. Life expectancy at any adult age can be considered as an indicator of adult mortality. However, the most frequently used measure for this purpose is the probability of dying between ages 15 and 60 or, in symbols, 45q15. This value can be computed directly from age-specific mortality rates or from life tables. For Timor-Leste, the probability of dying between ages 15 and 60 was 0.291 for males and 0.257 for females. These values can be considered high. For the more developed countries these values are 0.174 for males and 0.079 for females and for the less developed countries they are 0.217 for males and 0.158 for females (United Nations Population Division, 2011).

It is interesting to note that infant mortality in the less developed countries is 7.6 times higher than in the more developed counties (0.046 against 0.006). However, adult mortality in the less developed countries is only one third higher than in the more developed countries (0.189 against 0.127). Infant mortality in Timor-Leste was 12.3 times greater than in the more developed countries and adult mortality was 1.2 times greater.

[9] The estimates of life expectancy conducted for Timor-Leste by the United Nations Population Division for the period 2005-10 are 59.94 years for males and 61.68 years for females.

As explained above, at present, and in most countries, survival probabilities are higher among females than males during adult ages. However, these differences are not the same between the more and the less developed countries. For example, in the more developed countries the difference between male and female life expectancy is 7.01 years while in the less developed countries it is 3.53 years. Regarding adult mortality, these differences are greater. In the more developed countries male adult mortality is 120.3 percent higher than female adult mortality. In the less developed countries it is only 37.3 percent higher.

As everywhere, adult women in the less developed countries are likely to have some behavioral and biological advantages over males, but such advantages are likely to be offset by their position in the society that may imply poor access to medical services, limited information about health, and several forms of discrimination regarding the possibilities of living a healthy life (for example, access to nutritious food).

High levels of illiteracy and limited access to education may also counterbalance adult women's biological and behavioral advantages over adult men. In the case of Timor-Leste, the difference was quite small. Male adult mortality was only 13.2 percent lower than female adult mortality, which was much smaller than the average difference observed in the less developed countries. This value is likely to be related to the position of women in the society and also to the high level of fertility prevailing in the country. Frequent pregnancies seem to affect substantially the health of women (and children).The processes of pregnancy, labor and childbirth put an enormous strain on a woman's body. In addition to nutritional drain, there is a lot of blood loss after childbirth. Going through the process very often will most likely exhaust a woman's body. Frequent births also do not allow time for a woman's body to heal. In most cases, this can lead to *maternal depletion syndrome* which results into anaemia, among other effects. Hence, the behavioral and biological advantages of women over men regarding mortality can be seriously counterweighed by the high fertility in Timor-Leste.

According to the 2004 Census, the probability of dying between ages 15 and 60 were 0.279 for males and 0.232 for females. As indicated earlier, according to the 2010 census these probabilities were 0.291 for males and 0.257 for females. Hence adult mortality appears to have experienced an increase during the inter-censual period. Nevertheless, differences were small and, consequently, they are likely to have been as a result of the utilization of different estimation methodologies. It seems that, contrary to early-age mortality levels, adult mortality has not experienced major changes during recent years.

Life tables for the districts were constructed but only life expectancies at birth are presented in this monograph (Table 7). Dili had the highest life expectancy at birth while Ermera had the shortest. Seven districts showed a life expectancy at birth greater than the national average: Aileu, Covalima, Dili, Liquica, Lautem, Manufahi and Manatuto. The ranking of the districts according to life expectancy at birth was not much different from that regarding infant and child mortality (see Table 5). This was not surprising considering that the calculation of life tables strongly depended on early-age mortality.

Table 5: Life expectancy at birth and probability of dying between ages 15 and 60 years by sex according to district

District/sex	E(0)	45q15
Timor-Leste	59.48	0.274
Male	58.72	0.291
Female	60.35	0.257
Ainaro	59.16	0.278
Male	57.53	0.305
Female	60.85	0.251
Aileu	62.14	0.243
Male	60.80	0.266
Female	63.53	0.220
Baucau	58.10	0.291
Male	57.83	0.301
Female	58.38	0.281
Bobonaro	55.41	0.324
Male	55.39	0.331
Female	55.43	0.317
Covalima	60.47	0.263
Male	59.08	0.286
Female	61.91	0.238
Dili	64.14	0.220
Male	62.98	0.240
Female	65.35	0.199
Ermera	53.96	0.342
Male	53.13	0.359
Female	54.82	0.324
Liquica	60.66	0.261
Male	58.42	0.295
Female	62.99	0.226
Lautem	62.50	0.239
Male	60.80	0.266
Female	64.27	0.211

Continued

Table 5: Life expectancy at birth and probability of dying between ages 15 and 60 years by sex according to district

District/sex	E(0)	45q15
Manufahi	62.14	0.243
Male	60.80	0.266
Female	63.53	0.220
Manatuto	59.72	0.273
Male	56.48	0.277
Female	63.08	0.268
Oecussi	59.42	0.276
Male	58.66	0.292
Female	60.22	0.259
Viqueque	57.93	0.293
Male	59.33	0.283
Female	56.48	0.304

3.3. Adult Mortality

Table 5 also shows adult mortality as indicated by the probability of dying between age 15 and 60. The differences among districts were similar to those observed regarding life expectancy at birth. The lowest rates corresponded to Dili and the highest to Ermera, followed by Bobonaro and Baucau. Only in Viqueque district, the adult mortality rate among females was greater than that for males. As was the case with under-five mortality differences among districts, adult mortality differences appeared to follow the level of socio-economic development of the district. This association is suggested by the relationship between adult mortality and literacy. The respective correlation coefficient in this case was -0.67.

CHAPTER 4

MATERNAL MORTALITY

4.1 Overview

The first time maternal mortality was considered as a major health concern was at the *1987 Safe Motherhood Conference in Nairobi, Kenya*. It was pointed out that in many less developed countries, maternal mortality rates were 100 times higher than in the more developed countries. Subsequently, the 1993 report from the World Bank revealed that maternal mortality was a major cause of death among women of reproductive age in the less developed countries. During the 1990s and 2000s, several international fora established one of their main goals as a reduction in maternal mortality. It was the main case presented at the *1990 World Summit for Children, the 1994 International Conference on Population and Development, the 1995 World Conference for Women, and the 2000 Millennium Summit* (Hill, et al, 2001; World Health Organization, 2012b).

The growing attention to maternal mortality has resulted in a substantial demand for maternal mortality estimates at the national and sub-national levels. However, a major problem has been the lack of data or the quality of the data available. Civil registration systems are the natural source of statistics on maternal deaths, but they are not available or they remain inadequate in quality of registration in most less developed countries. Actually statistics on maternal deaths are even found to be problematic in the more developed countries.

Sample surveys, in particular the Demographic and Health Surveys (DHS) are being increasingly used to estimate maternal mortality deaths by identifying maternal deaths in the household or in the family. However, sample sizes are not large enough to produce reliable estimates in the short term or at the sub-national level.

Given the inadequacies of civil registration and surveys as a source of data to estimate maternal mortality, it was decided that census could be appropriate for generating reliable estimates on maternal mortality in the less developed countries. During the 2010 round of census many countries have included a question to measure maternal mortality. Usually, they consist of additional questions included in the set of questions on deaths in the household during the past 12 months. The reason for including this question is still under debate considering the limitations of the general question and of maternal mortality itself. In spite of the efforts made in many countries, reliable estimates on maternal mortality remain elusive.

4.2. Information collected and definition of concepts

In the case of Timor-Leste census data produced a reasonable estimate, in spite of the limitations of the data on adult mortality. The questions included to measure maternal mortality are part of the question on number of death in the household during the past 12 months. The general question was: *How many members of this household died in the last 12 months? (August 2009 and July 2010).* In addition, it collected the name, sex and age at death of the deceased, the following complement was added:

If the deceased was female 15 years and above, did (name) die..........?

- *during pregnancy,*
- *giving birth,*
- *within six weeks after delivery*

Any positive reply was considered as a pregnancy related cause of death.

A conceptual discussion is necessary here. According to the World Health Organization (1993) report, *a maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental causes*.

An actual maternal death involves a precise cause of death information. This concept is different from a *pregnancy-related death*, which refers mainly to the timing of death relative to pregnancy, childbirth and post-partum period. It is defined as *the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of cause*. A major difference between these two concepts is that a pregnancy-related death includes the death of a pregnant woman as a result of an accident which is not related to her pregnancy (for example, a car accident).

The questions included in the 2010 census measure pregnancy-related deaths and not strictly maternal deaths. Having made this clarification and to avoid rhetoric confusions and also for reasons of convenience, the terms maternal deaths and maternal mortality will be used here. Actually, pregnancy-related deaths is an alternative definition that, nonetheless, allows measurement of deaths that are related to pregnancy, even though they do not strictly conform to the standard maternal *death concept*, in settings where accurate information about causes of deaths based on medical certificates is unavailable (World Health Organization, 2012a).

Another common confusion is between maternal mortality ratio (MMR) and maternal mortality rate (MM Rate). The most commonly used measure is the MMR, which is the number of maternal deaths by 100,000 live births during a given period, usually a year. This measure, which is designed to express obstetric risk, is frequently incorrectly referred to as maternal mortality rate. They are different. The MM Rate is the number of maternal deaths per 1,000 women in reproductive age (15-49). This is an indicator of the risk of maternal deaths among women of reproductive age (Fortney, 2006).

Another indicator of maternal mortality is the proportion of adult female deaths due to maternal causes which is just the division between the number of maternal deaths and the number of deaths among women of reproductive age.

A fourth indicator of maternal mortality is the lifetime risk of maternal death (LTR). This measure indicates the chances of a woman dying from maternal causes over the course of her 35 years reproductive life span. This indicator takes into account the probability of a death due to maternal causes each time a woman becomes pregnant. Although the formula is much more complex a good approximation can be obtained by multiplying the maternal mortality rate by 35 (Hill et al, 1991; Health World Organization, 2012b)[10].

The enumeration of maternal deaths in censuses is part of the enumeration of deaths that have taken place in the household during the past 12 months, which usually need to be adjusted for under-enumeration. In addition, the calculation of the most frequently utilized maternal mortality indicator, the MMR requires the number of births. Since these measures involve census data, the information on the number of births comes from the question on children born alive during the 12 month previous to the census. However, this value is usually under-enumerated and needs to be adjusted.

4.3. Maternal Mortality Indicators

Table 6 shows the data required to estimate several measures of maternal mortality, the adjusted data and the respective results.

With the previous information four measures of maternal mortality were estimated: MMR (570 maternal deaths per 100,000 births), proportion of deaths due to maternal causes among women in reproductive ages (0.21 or 21%), MM Rate (0.97maternal deaths per 1,000 women) and the LTR (1 in 33.7). In addition to the total, the table shows the respective values for each 5-year age group of women in reproductive age.

Table 6: Calculation of total and age-specific maternal mortality ratios (per 100,000 births)

Age at Death	MMR (per 100,000 live births)	Proportion of deaths due to maternal causes	MM Rate (per 1,000 women)	Lifetime risk of maternal deaths. 1 in:
15	1,037	0.23	0.66	3
20	534	0.33	1.19	6
25	402	0.26	1.11	6
30	352	0.17	0.84	4
35	754	0.29	1.60	8
40	483	0.08	0.52	3
45	1,589	0.11	0.81	4
Total	570	0.21	0.97	34

10 The complete formula is LTR = {(T15-T50)/l1} *MMRate (World Health Organization, 2021b)

These results indicate that maternal mortality is quite high in Timor-Leste. The WHO, UNICEF, UNFPA and The World Bank estimates of maternal mortality for 1990 to 2010 (World Bank, 2012b) estimated that, among the more developed countries the MMR is 16 maternal deaths per 100,000 births; in the less developed countries this value is 240. MMR in Thailand and Vietnam are comparatively low at 48 and 59, respectively. In Myanmar, Indonesia and the Philippines ratios are higher at 200, 220 and 99, respectively.

A method that is quite appropriate to measure maternal mortality is the lifetime risk of maternal mortality (LTR), which describes the cumulative loss of human life due to maternal death over the female life course. It can be defined as the probability that a 15-year-old female will die eventually from a maternal cause assuming that current levels of fertility and mortality (including maternal mortality) do not change in the future, taking into account competing causes of death. In Timor-Leste, the probability that a woman who is beginning her reproductive life died of maternal causes is 1 in 33. In the more developed countries, LTR is 1 in 3,800 and in the less developed countries it is 1 in 150.

It is interesting to compare the MMR obtained here with those from other sources. This is presented in Table 7. Three additional sources are presented. The estimate obtained here is consistent with that obtained in the 2009-10 using a direct method by the Demographic and Health Survey. The value is for the 6 years preceding the date of the survey. It is important to mention that the 95 percent confidence interval places the true MMR for 2009-10 anywhere between 408 and 706. The second alternative source is the previously cited WHO, UNICEF, UNFPA and the World Bank estimates (World Health Organization, 2012b). The MMR is much lower than the one estimated here. Nevertheless, this report computed a *range of uncertainty*, which is the possible interval within which the estimated value may vary. In the case of Timor-Leste, the interval was between160 and 560. The estimate produced by the United Nations Population Division (2011) is definitely much lower than that obtained here. A major problem regarding maternal mortality estimates are the substantial variations according to sources and approaches utilized for the measurement. In spite of several recent efforts, not only regarding the utilization of censuses but other complementary approaches, a harmonization of estimates remains elusive.

Table 7: Maternal mortality estimate according to different sources (per 100,000 births)

Source	Maternal mortality ratio
2010 Population and housing Census	570
* Timor-Leste DHS 2009-2010	557
** WHO, UNICEF, UNFPA and The World Bank estimates	370
*** United Nations Population Division	300

* National Statistics Directorate, Ministry of Finance, and ICF Macro. 2010. Timor-Leste Demographic and Health Survey 2009-10. Dili, Timor-Leste.

** World Health Organization (WHO). 2012b. Trends in maternal mortality: 1990 to 2010. WHO, UNICEF, UNFPA and The World Bank estimates, World Health Organization, Geneva

*** United Nations Population Division. 2011. World Population Prospects: The 2010 Revision, Department of Economic and Social Affairs, CD-ROM Edition, New York

In any case, no matter the source, MMR for Timor-Leste is one of the highest in the world. It is urgent that the Government addresses this issue by establishing sound programs to reduce maternal mortality, or by strengthening those already available (see Ministry of Health 2002). The government of Timor-Leste recognizes the importance of the availability of good basic and comprehensive essential services for all women during pregnancy and childbirth. The intent of the government is to reduce levels of maternal mortality and morbidity in the country. However, the data presented in this chapter indicates that more effort should be made by government.

CHAPTER 5

CONCLUSIONS AND RECOMMENTATIONS

5.1. Conclusions

The substantial and universal decline in mortality experienced by the population under-five years suggests that the government's health policies are in the right direction. Considering the high levels of early-age mortality still prevailing in the country, more efforts should intensify. However, it is important to remember that there is a limit to the mortality decline that can be attained through health policies if social development and the standard of living of the population remain stagnant. Therefore, the implementation of programs directed to improve the well-being of the people and the entire society is to give equal access to the benefits of economic development; and this would result in a more thorough early-age mortality decline.

Adult mortality is also substantial in Timor-Leste. Contrary to under-five mortality it has not declined during the past decade. Adult mortality appears to have received limited or no attention in public health programs and interventions. One example is the case of tuberculosis (TB).It is a major public health problem in Timor-Leste, but it has received less attention than it deserves considering the magnitude of the problem. Although no reliable information is available about its prevalence, the fact that the pattern of adult mortality corresponds to a population with high TB prevalence is an indication of the severity of the situation. It is understandable that more efforts and resources are dedicated to reduce early-age mortality, but adult mortality should also be subject of public health programs and interventions[11].

Maternal mortality is a major health issue in Timor-Leste. As in most countries, estimates vary according to source and methods, but in all cases estimated rates and ratios are extremely high; actually, Timor-Leste exhibits one of the largest maternal mortality in the world. The Government of Timor-Leste is strongly committed to reduce maternal mortality. Several programs are being implemented, such as a reproductive health strategy, a national family planning program, training for health providers on safe deliveries and emergency obstetric care, and the equipping of established health facilities. Efforts appear to be in the right direction, but they should intensify given the severity of the problem.

[11] Regarding HIV, it is only a recent problem in Timor-Leste. Cases of HIV have been on the rise, although no information is available on the prevalence for the country as a whole.

5.2 Policy implications and recommendations

There was an important finding revealed by this data, that is worth emphasizing. Infant mortality rates were high in all the groups or categories established by the variables considered in the differential analysis. Obviously, infants born from mothers in a given category, had more possibilities to survive than those born from mothers in other groups, but regardless of the category, the rates were quite high. As a point of comparison and considering that infant mortality rate estimated for the less developed countries is 46 deaths per 1,000 births, in all the categories considered in Timor-Leste, Infant mortality rate was higher than 46. This fact needs to be given special attention for future research.

It is recommended that; a policy-oriented research on mortality should be conducted using the 2010 census data. The study to be carried out should focus on the identification of health, economic, social policies and, in general, socio-economic changes, that could have affected the substantial infant mortality decline that the country experienced during the past decade. As suggested, the role of the *Cuban Medical Brigade* should be systematically studied and lessons should be learned. However, it would also be important to evaluate some of its possible weaknesses and discuss on how to make its work even more effective.

In addition, more interest should be in the study on adult mortality. Although the census data appears to have serious limitations, adjustments can be made and some analyses conducted. For example, it would be of much interest to carry out an in-depth study on adult mortality differentials among the districts.

To promote further improvement in the people's welfare, it is recommended that Government and Civil society take appropriate measures to improve access to communication, information, education and health services that would help individuals attain better living standards. This will enable the country to alleviate poverty, reduce infant, child and maternal mortality and improve on the mother and child health. Special attention and consideration should be made to the marginalized population, who come from lower socio-economic groups, districts and sub-districts that exhibited high mortality levels.

Finally, the issue of comparability of the estimates of under-five mortality obtained with census data and the DHS should be examined and clearly explained to data users. Differences observed in the information from the two data collection instruments were expected; however, it often happens that, policy makers get confused about these differences and distrust one of the data sources, or even both. However, it is important to establish whether the differences identified are of limited significance or substantial to the findings and suggest appropriate consistency remedies to the problem.

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APPENDIX A

UNDER-5 MORTALITY ESTIMATES

Indirect methods of mortality estimate produce reliable estimates of infant and child mortality, but a regrettable by-product is the somewhat common mistake of producing estimates with a limited understanding of the formal demographic structure of the data or the logic of the estimation procedure (Feeney, 1991). Basic assumptions are forgotten and erroneous interpretations are sometime made. For this reason, it was considered important to include in this chapter a discussion of some relevant methodological issues regarding these methods.

The most frequently used indirect methods are the Brass-type methods. This approach was pioneered by William Brass and improved by others (Popoff and Judson. 2004; United Nation, 1983). Its main advantage is that it requires no data about children age, nor about births or deaths in a specific reference period. It requires information of women's age within five-year age groups. This approach, therefore, avoid two problems to accurate direct estimation: errors in age reporting and the appreciation of the reference period.

The questions needed for the Brass-type method are usually included in censuses. They are designed to obtain information from the respondent (the woman herself) the number of children she has ever born, and the number that has subsequently died. It is, obviously insufficient to ask just: How many children have you had? and how many of those children are still alive? Clarifying sentences should be added during the census interview to make sure that all children who have died or live in other households are included and that fostered children are excluded. Stillbirths should also be excluded.

The basis of the method is to transform the proportion of children who have died into probabilities of dying. The result, using the Trussell or the Palloni and Haligman versions of the original Brass method, is a series of seven estimates of infant (less than 1 year) and child mortality (1 to 5 years), one for each five-year age group of women in reproductive ages (that is 15-19, 20-24, ... 45-49 years). Each estimate is dated somewhere between one and fifteen years before the census (United Nations, 1983).

It is important to note that every stage of the technique is heavily dependent on models of mortality, particularly in model life tables. The Trussell version makes use of the Coale-Demeny model life table system and the Palloni-Haligman of the United Nations system. Consequently, an infant and child mortality show important variation between different patterns of mortality models and, therefore, it is essential to select an appropriate system and pattern.

It is also relevant to emphasize that the estimates obtained with these variants are presented as a time series; however, they are not. Each point is produced entirely from the data corresponding to an age group of women. The set of seven points does not represent the early-age mortality experience of a cohort of women, but just the experience of the respective age group of women located in an estimated date. The assumption underlying this is that mortality of children is related solely to their age.

The previous assumption fails severely at young ages of women, which includes the most recent one or two points (15-19 and 20-24 years). In fact, the most recent point is highly erratic and usually shows higher mortality than the general trend (although it may be lower in some cases). In most cases this first point is ignored. The second most recent point (20-24 years) may also be out of range regarding the overall trend (Statistical Institute for Asia and the Pacific, 1994). The results require a careful interpretation and cannot be taken at face value.

The usual results of this method's application suggest a sound decline in under-five mortality up until the most recent one or two estimates, which then indicate a rise in mortality. This rise was due to the previously mentioned bias. This error affects the Timor-Leste 2010 Census data, as it shown in the next section (see Table 2). For this reason, it is important to discuss this issue with more details.

The first source of this imprecision is the small number of women in the group 15-19 years and the second is that a disproportionate number of births in this age group are likely to be vulnerable because they are mainly first births which have higher mortality. However, more important than birth order appears to be the young age of the mother at time of birth which is strongly associated with educational and socio-economic disadvantage. The result is a usually strong bias toward overestimation of mortality during the recent past. This error may extend into the next age group, 20-24 years, affecting the second most recent estimate. The main reasons are that the parity may still be low and mortality easily biased by the proportion of births which occurred when the mother was a teenager. They may also be a result of age heaping on age 20, and general age exaggeration where teenage mothers are declared to be older and are, consequently, placed in the 20-24 age group. By the 25-29 estimates the error is diluted by the prevalence of children born when their mothers were over age 20.

There have been two attempts to adjust the estimates affected by this problem. Ewbank (1982) proposed an approach that assumes that the bias is caused by an excess mortality among first births. He demonstrated that corrections can be made if the excess mortality of first births can be quantified and used in a procedure to standardize for birth order. He applied this approach to Bangladesh, but it cannot be used for Timor-Leste because of lack of the necessary data. The second approach was developed by Fernandez-Castilla (1988) and is based on models of mortality by birth order and age of mother from which correction factors are derived. An unusual combination of high fertility (around 7 children per woman) and high age at marriage (over 23 years) make the correction factor to be used for Timor-Leste negligible, in spite of the fact that the data clearly indicate a strong bias. As shown in the next section, another approach was used. Details about these two methods are not included in this monograph. The reader interested on them can examine the original source or the text Estimation of Demographic Parameters from Census Data from the Statistical Institute for Asia and the Pacific (1994).

Other assumptions in the Brass-type of methods are that mortality decline has been linear, that the same mortality pattern has been maintained throughout the period under consideration, and that fertility has been constant. All these assumptions are probably broken to some degree in the case of Timor-Leste (as in most countries where the method is utilized), but the technique is, however, quite robust. Changes in mortality patterns and a moderate fertility decline are not very important. Gradually falling fertility will bias the method toward slight overestimation of mortality. This is not serious because it usually countering latent tendencies to under-estimation (Statistical Institute for Asia and the Pacific, 1994).

Taking into consideration the previous methodological discussion, infant and child mortality are estimated in this section. The first stage is to identify the model life table pattern to which the observed pattern fits better. The main issue in this selection is the difference between infant and child mortality. Table 1 shows the results of the indirect estimate of infant and child mortality using the Trussell and the Palloni-Haligman variants of the Brass method . Results are presented in terms of rates (probabilities of dying) and are by sex and age of women for the four families of life table models of the *Coale-Demeny system* (Trussell) and the five families of models of the United Nations system (Palloni-Halligman) . The years to which these estimates correspond are also indicated.

Table A-1: Estimates of infant and child mortality rates by sex based on different model life tables

Sex	Coale-Demeny model life tables (Trussell)					United Nations model life tables (Palloni-Haligman)					
	Year	West	North	East	South	Year	Latin Am.	Chilean	So. Asian	Far East	General
Males											
Infant											
15-19	2009.6	0.108	0.106	0.108	0.103	2009.4	0.101	0.111	0.101	0.101	0.101
20-24	2008.5	0.083	0.076	0.087	0.083	2008.4	0.079	0.091	0.081	0.081	0.081
25-29	2006.8	0.075	0.067	0.081	0.078	2007.0	0.073	0.086	0.074	0.075	0.075
30-34	2004.8	0.082	0.073	0.091	0.085	2005.1	0.079	0.096	0.082	0.082	0.082
35-39	2002.5	0.088	0.076	0.099	0.092	2002.8	0.085	0.105	0.088	0.087	0.088
40-44	1999.9	0.099	0.084	0.112	0.102	2000.1	0.093	0.120	0.100	0.096	0.097
45-49	1996.9	0.105	0.088	0.121	0.109	1996.8	0.101	0.130	0.109	0.100	0.104
Child											
15-19	2009.6	0.055	0.077	0.037	0.055	2009.4	0.066	0.030	0.059	0.055	0.057
20-24	2008.5	0.038	0.049	0.026	0.034	2008.4	0.043	0.021	0.040	0.037	0.038
25-29	2006.8	0.032	0.041	0.023	0.029	2007.0	0.037	0.019	0.035	0.033	0.033
30-34	2004.8	0.037	0.045	0.028	0.036	2005.1	0.043	0.023	0.041	0.038	0.039
35-39	2002.5	0.041	0.049	0.032	0.042	2002.8	0.048	0.027	0.046	0.042	0.044
40-44	1999.9	0.048	0.056	0.039	0.053	2000.1	0.056	0.034	0.057	0.049	0.051
45-49	1996.9	0.053	0.060	0.044	0.061	1996.8	0.064	0.039	0.066	0.053	0.058

Continued

Table A-1: Estimates of infant and child mortality rates by sex based on different model life tables

Sex	Coale-Demeny model life tables (Trussell)					United Nations model life tables (Palloni-Haligman)					
	Year	West	North	East	South	Year	Latin Am.	Chilean	So. Asian	Far East	General
Female											
Infant											
15-19	2009.5	0.102	0.100	0.102	0.097	2009.4	0.096	0.106	0.096	0.096	0.096
20-24	2008.4	0.080	0.073	0.084	0.080	2008.4	0.076	0.087	0.078	0.078	0.078
25-29	2006.8	0.074	0.066	0.080	0.077	2007.0	0.072	0.084	0.073	0.074	0.074
30-34	2004.7	0.079	0.070	0.087	0.083	2005.1	0.076	0.093	0.079	0.079	0.079
35-39	2002.4	0.082	0.071	0.092	0.087	2002.8	0.080	0.098	0.083	0.082	0.082
40-44	1999.9	0.096	0.082	0.109	0.100	2000.1	0.091	0.117	0.097	0.093	0.094
45-49	1996.9	0.103	0.086	0.118	0.107	1996.8	0.099	0.127	0.106	0.098	0.102
Child											
15-19	2009.5	0.051	0.071	0.034	0.048	2009.4	0.061	0.027	0.054	0.050	0.052
20-24	2008.4	0.035	0.046	0.025	0.031	2008.4	0.040	0.019	0.037	0.035	0.036
25-29	2006.8	0.031	0.040	0.023	0.028	2007.0	0.036	0.018	0.034	0.032	0.032
30-34	2004.7	0.035	0.043	0.026	0.033	2005.1	0.040	0.022	0.038	0.035	0.036
35-39	2002.4	0.037	0.044	0.028	0.038	2002.8	0.043	0.024	0.042	0.038	0.039
40-44	1999.9	0.046	0.054	0.037	0.050	2000.1	0.054	0.032	0.055	0.047	0.049
45-49	1996.9	0.051	0.058	0.042	0.059	1996.8	0.062	0.038	0.064	0.051	0.056

Notice that differences are substantial according to the model life table model used in the estimate. For this reason, as indicated above selecting the appropriate model is essential.

The life table pattern selected for this analysis is the *East model* from the Coale-Demeny system. The main reason for choosing this model is that it is especially compatible with a population with extremely high fertility, as is the case of the population of Timor-Leste. The difference between infant and child mortality is very large in terms that infant mortality rate is extremely high as compared with child mortality. An important determinant of infant mortality is the health status of mothers. The effect of high fertility on maternal and infant health is well documented. Maternal fertility pattern have a strong effect on infant mortality with probabilities of dying being higher for children born to mothers who are too young or too old, if the birth intervals are too short, or if the child is of high birth order (Fortney, 2006). Therefore the excess of infant mortality in Timor-Leste is probably related to the elevated risks associated with high fertility rates. On the other hand, child mortality is less dependent on maternal health status and, therefore, it is less affected by the additional vulnerability caused by high risk fertility behavior. Thus, compared with infant mortality rates, child mortality rates are lower. It is also important to note that children, who have been able to survive infancy within the context of a high fertility mother, are more likely to survive childhood.

It is of special relevance to note in Table 1 that in all cases infant and child mortality experience a decline while, starting at age group 20-24, an increase is observed. This issue was discussed in the previous section and it appears to be the result of a bias caused by the predominance of first births among women 15-19 as well as a disproportionate number of disadvantaged women in this age group. This bias is likely to split to the 20-24 age groups mainly as a result of errors in age reporting.

As it was also mentioned above, the available data, the marriage pattern and high fertility prevalent in Timor-Leste prevent the use of the available method to adjust this bias. There is, however, the option to extrapolate the estimates that correspond to the previous five age groups and which would correspond to earlier dates. It is relevant to point out that this extrapolation should be made with extreme caution.

Figures A-1.1 to A-1.4 show the distribution of infant and child mortality according to sex plotted as a time series (East model). In the four cases mortality appears to have a sudden recent increase after a sustained decline. This higher mortality rates appear to have occurred during the most recent two dates, which correspond to age groups 15-19 and 20-24. As it was advanced in the previous section, this increase is most probably caused by a bias in the data. It is possible that mortality experienced an increase, but it is quite unlikely that it was of the magnitude shown in Figures A-1.1 to A-1.4. As indicated earlier, the data needs to be corrected.

Figure A-1.1: Infant mortality rates plotted as a time series, 1996 to 2009, males (East model)

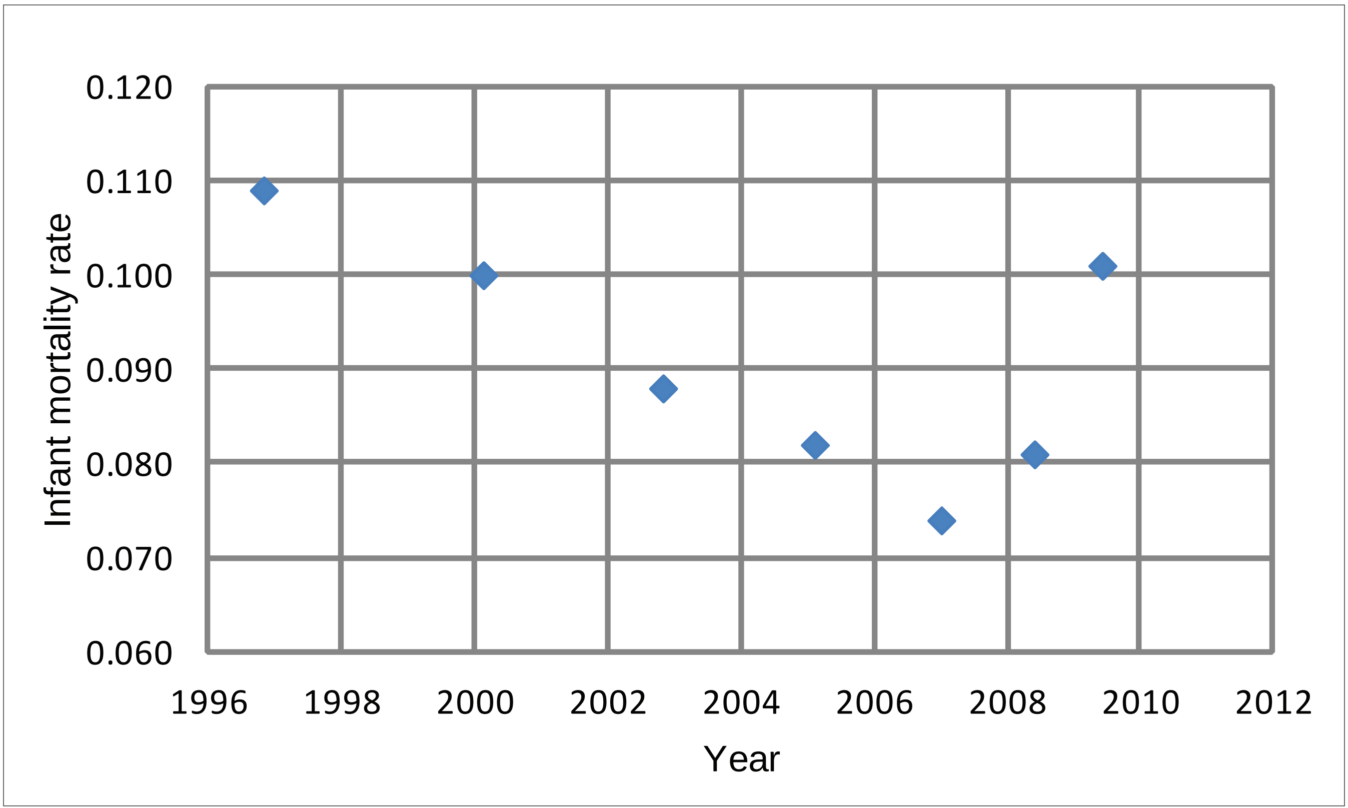


Figure A-1.2: Infant mortality rates plotted as a time series, 1996 to 2009, females (East model)

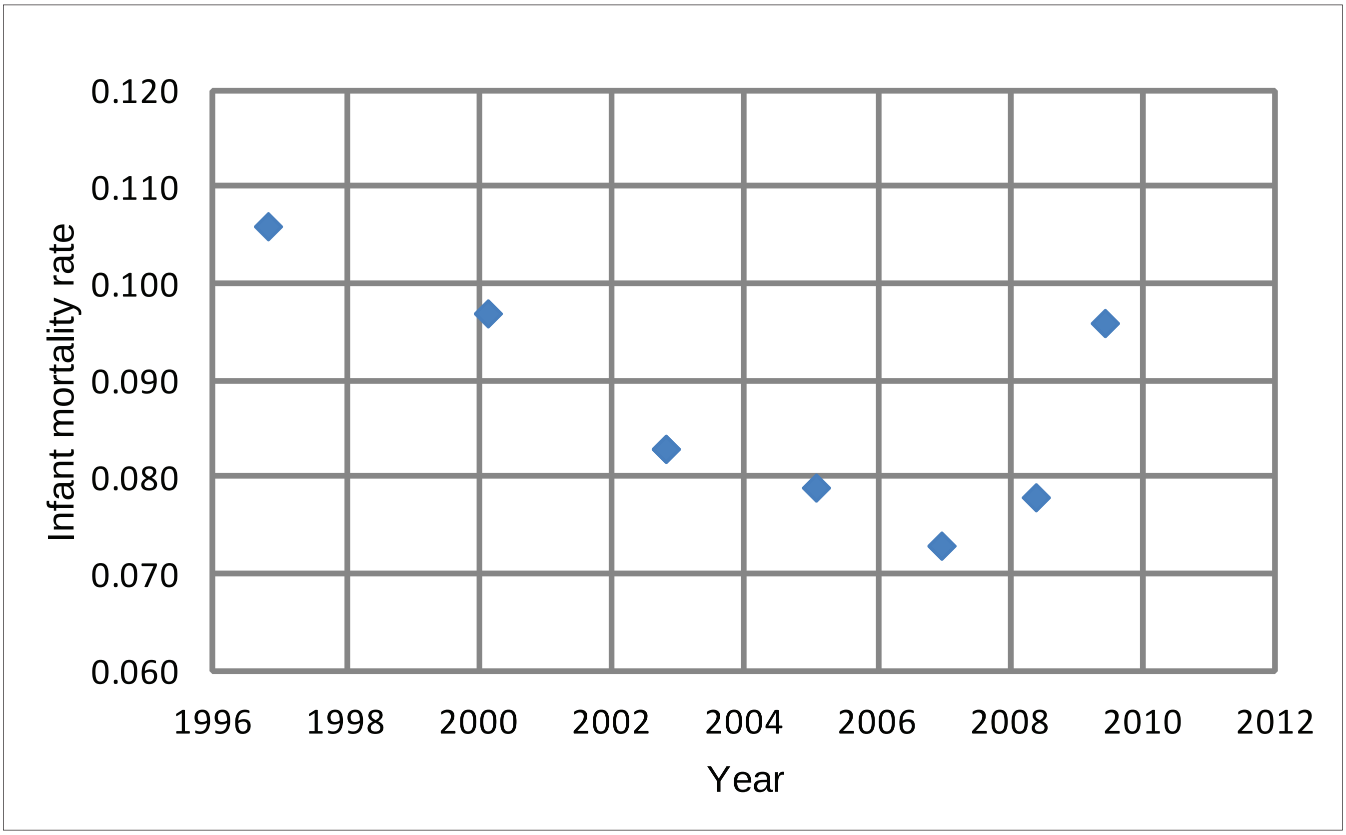


Figure A-1.3: Child mortality rates plotted as a time series, 1996 to 2009, males (East model)

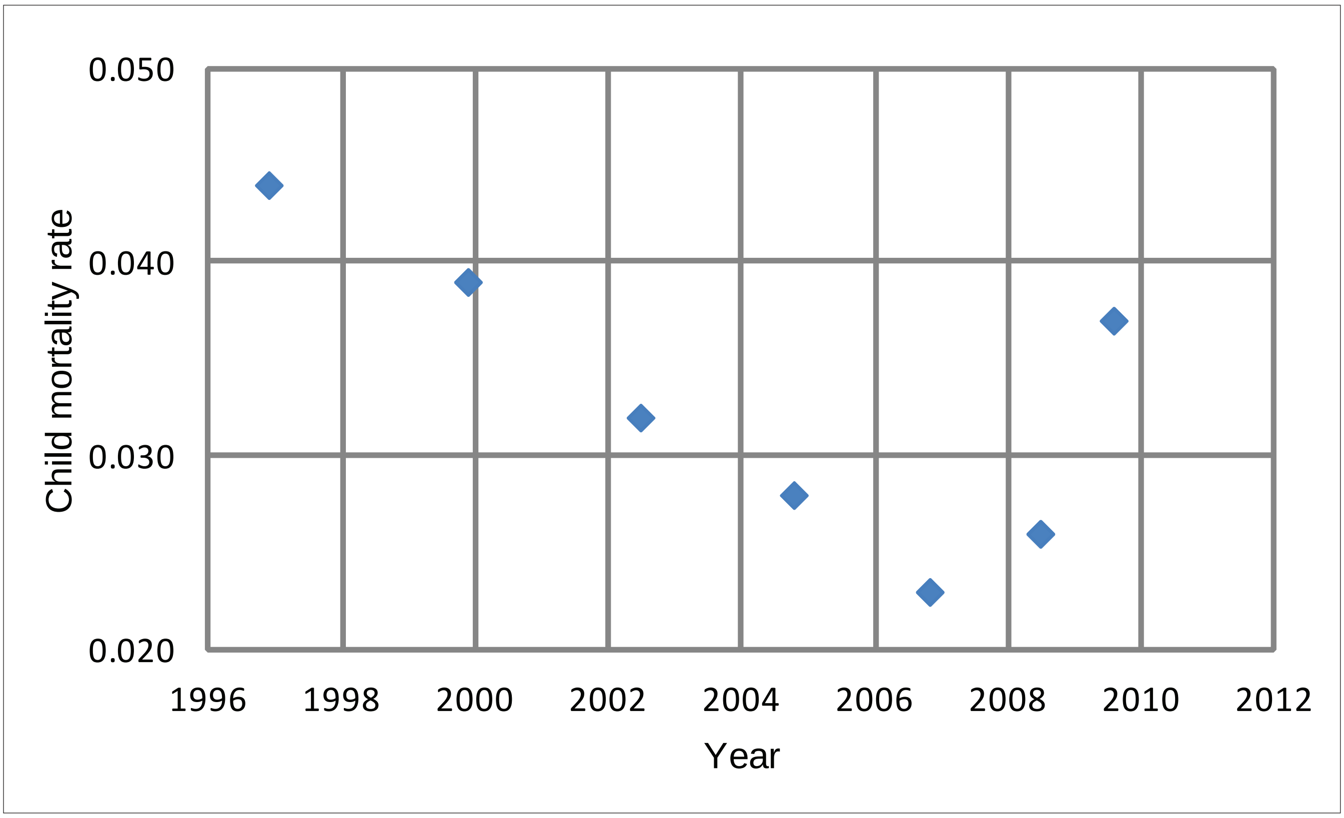
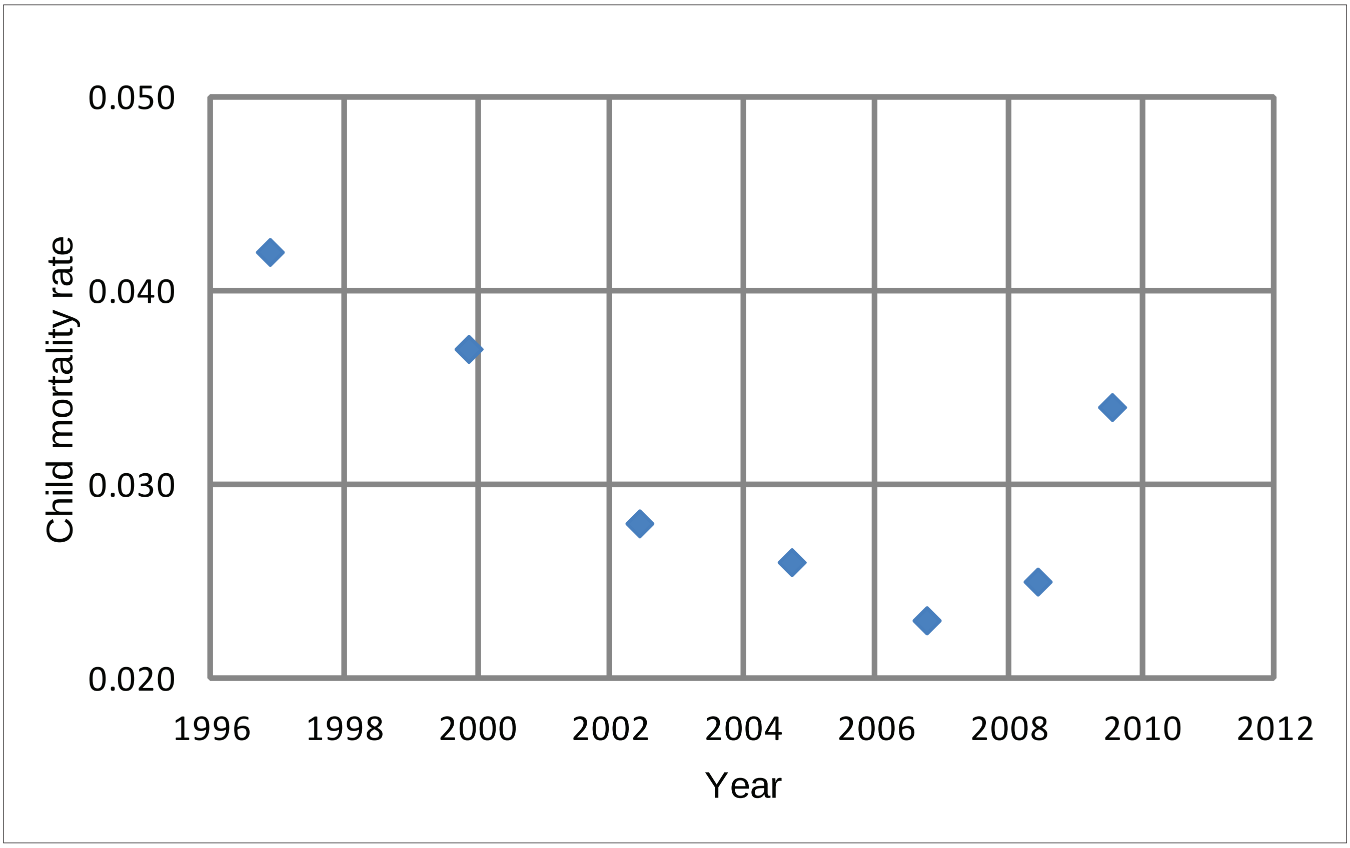


Figure A-1.4: Child mortality rates plotted as a time series, 1996 to 2009, females (East model)



The attention was centered in adjusting 20-24. The bias is so strong in the data corresponding to age 15-19, and the data is too sparse and erratic, that making a suitable correction is not recommended here. The second data point is more tractable (Statistical Institute for Asia and the Pacific, 1994).

Figure A-2.1 to A-2.4 shows the distribution of infant mortality and child mortality plotted as time series. This time, only the points correspond to age groups 45-49 to 24-29 were plotted. Linear equations were determined with these five points. Some points are not exactly within the straight line but a clear linear trend is unquestionable. The linear equation is presented at the bottom of the figures. The coefficient of determination is also shown (R-squared). It takes a value from 0 to 1, indicating how closely the plotted values fit a given line, in this case a straight line. The closer the values are to the line, the closer the R-squared is to 1. The coefficient in this case indicates a very close proximity of the plotted points to a straight line. The sixth point, corresponding to age 20-24, was estimated with the equation as it is explained next.

Figure A-2.1 : Identification of a linear equation to adjust infant mortality data, 1996 to 2009, males

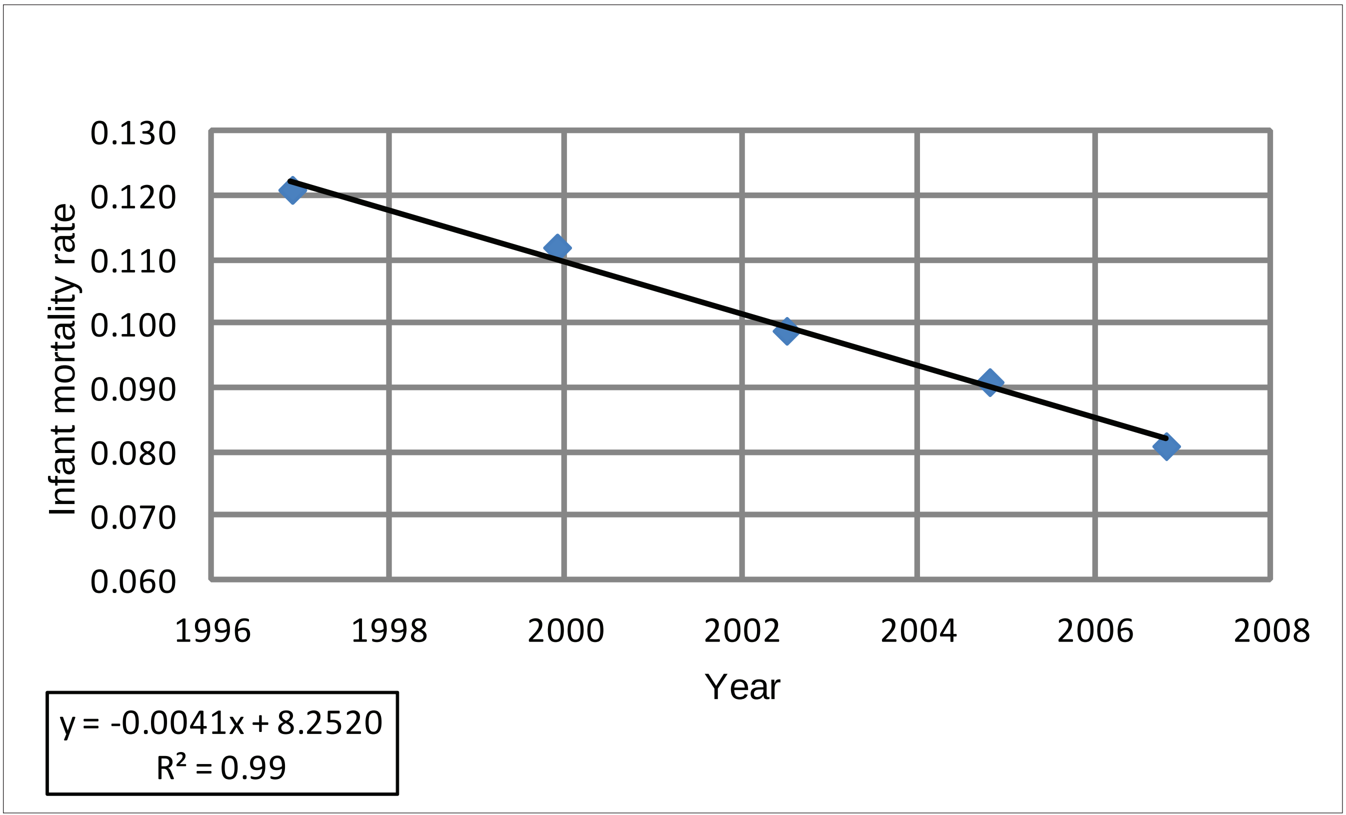


Figure A-2.2: Identification of a linear equation to adjust infant mortality data, 1996 to 2009, females

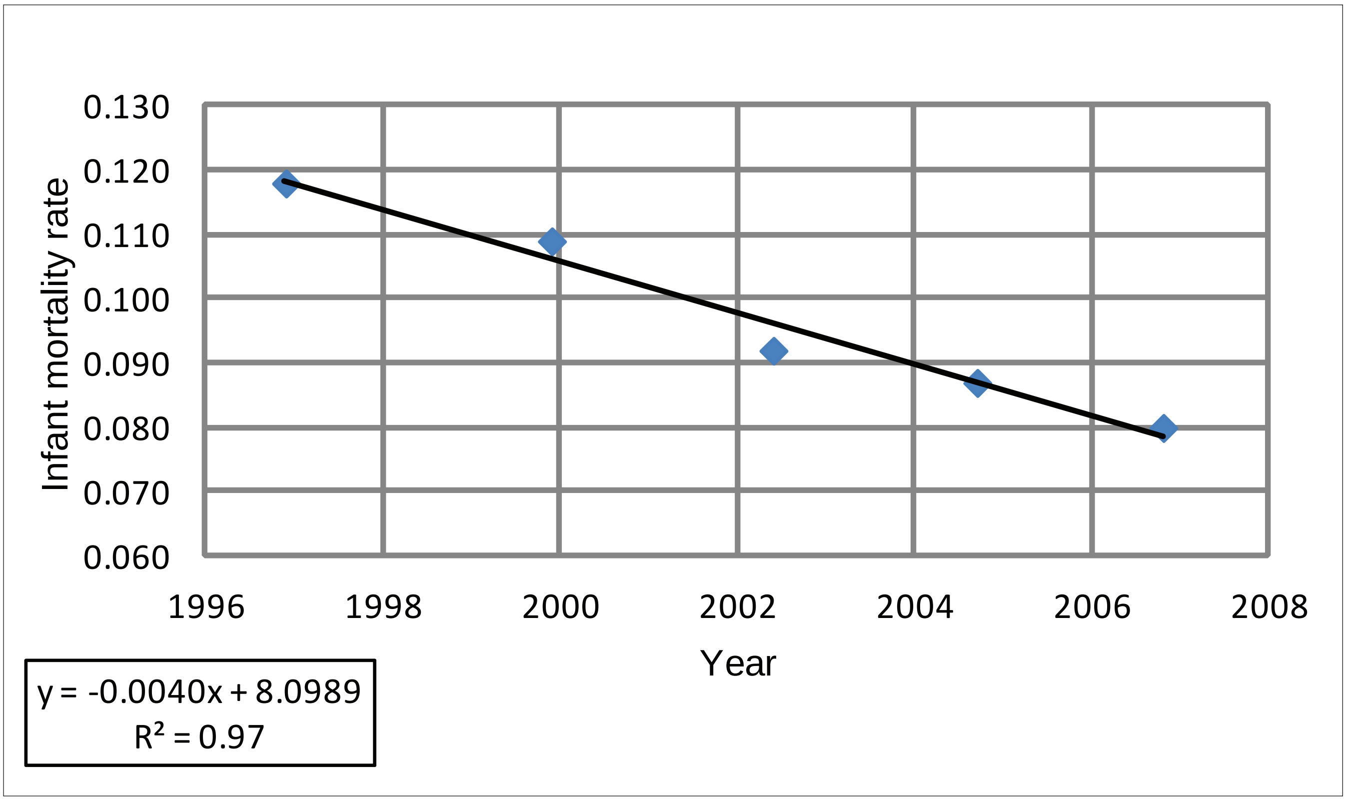


Figure A-2.3 : Identification of a linear equation to adjust child mortality data, 1996 to 2009, males

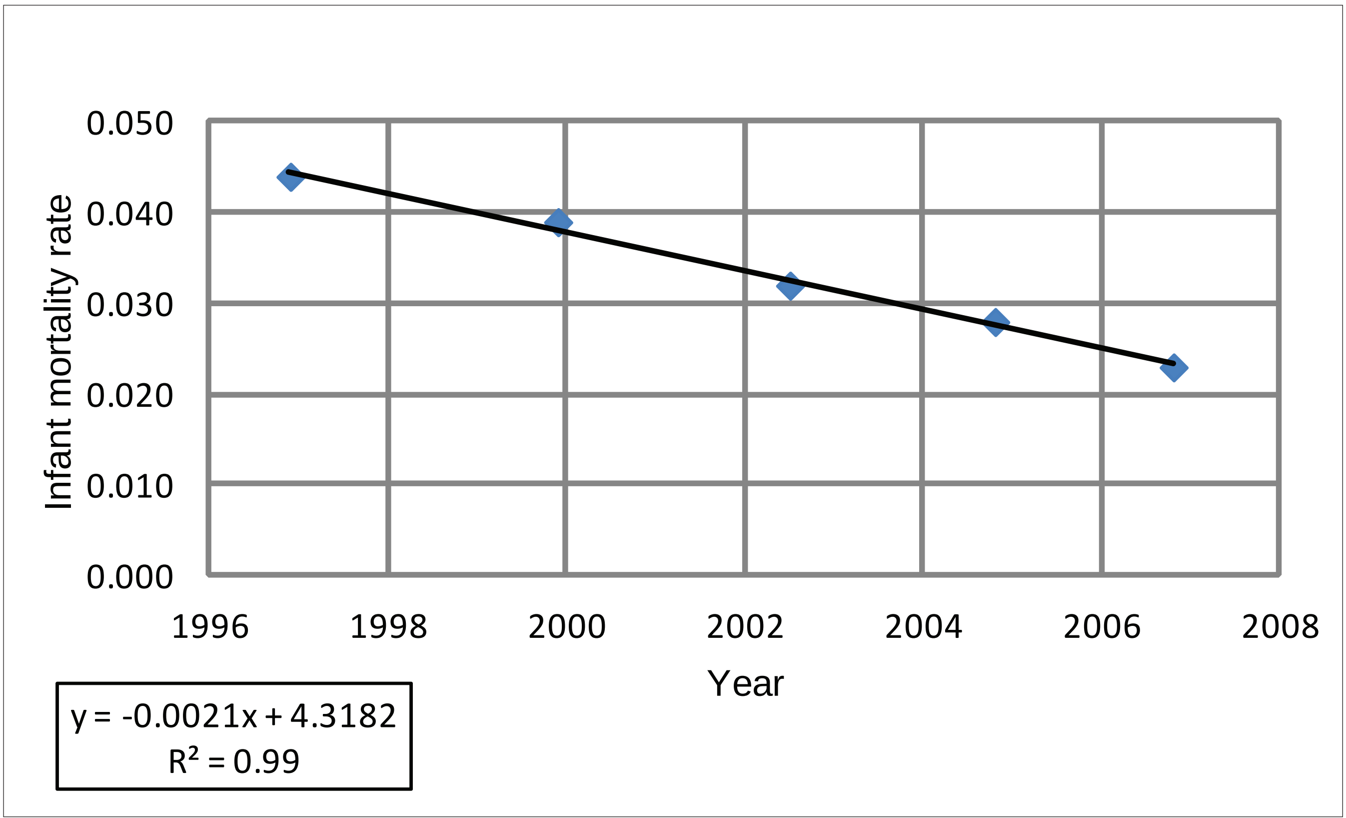
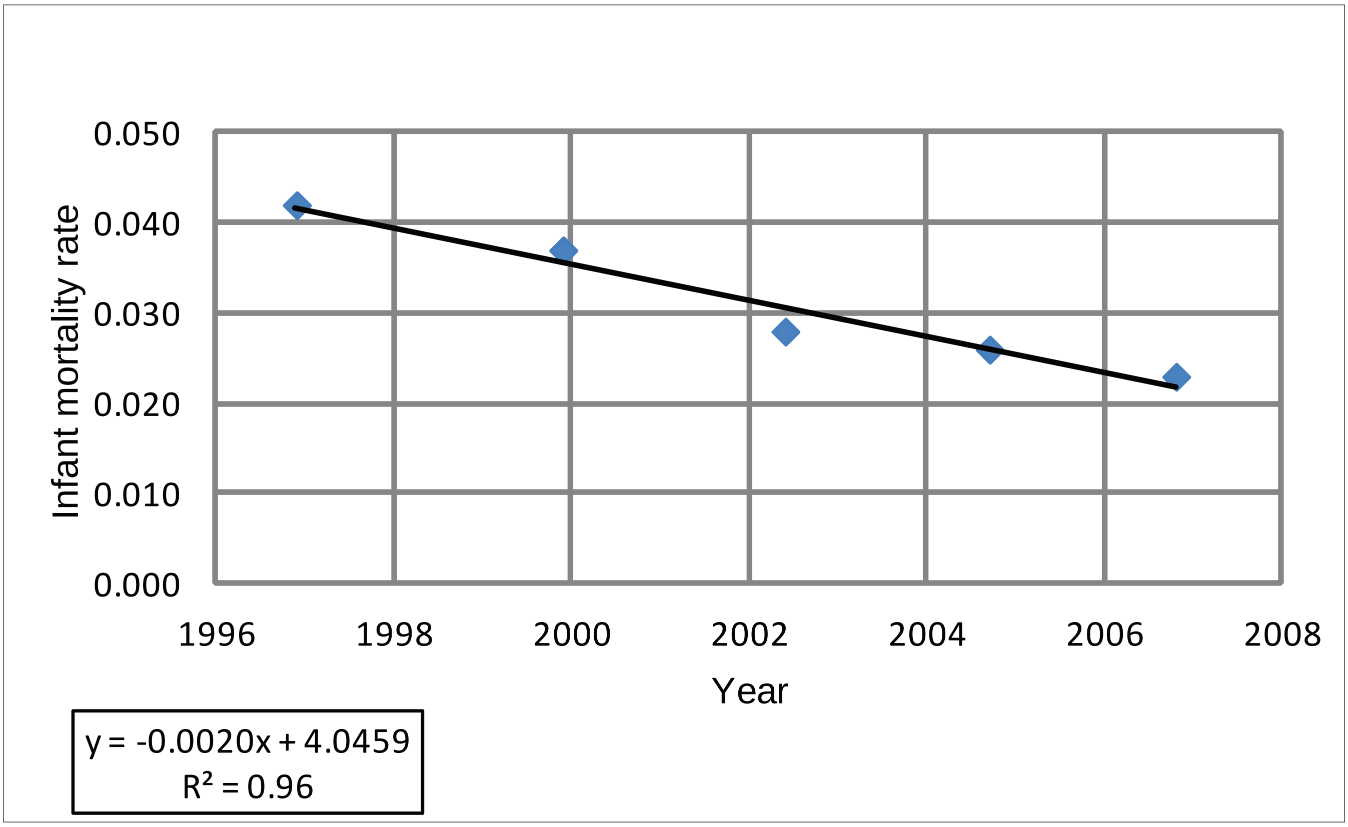


Figure A-2.4: Identification of a linear equation to adjust child mortality data, 1996 to 2009, females



As mentioned above, the procedure to adjust infant and child mortality corresponding to age group 20-24 assumes that the decline in mortality rates is linear. Therefore, the linear equations of Figures A-2.1 to A-2.4 were used to adjust infant and child mortality, particularly those values corresponding to age group 20-24 years. Table A-2 shows the unadjusted and adjusted infant and child mortality rates. Those rates for age groups 25-29 to 44-49 did not experience major changes since they are close to the linear trend. As expected, the value corresponding to age group 20-24 experienced a substantial decline. Figures A-3.1 to A-3.4 show the adjusted infant and child mortality rates plotted as time series.

Table A-2: Unadjusted and adjusted infant, child and under-five mortality rates by sex, 1996 to 2008

Age group	Males			Female			Total		
	Year	Unadjusted	Adjusted	Year	Unadjusted	Adjusted	Year	Unadjusted	Adjusted
Infant									
20-24	2008.5	0.087	0.075	2008.4	0.084	0.072	2008.5	0.086	0.074
25-29	2006.8	0.081	0.082	2006.8	0.080	0.079	2006.8	0.081	0.080
30-34	2004.8	0.091	0.090	2004.7	0.087	0.087	2004.8	0.089	0.089
35-39	2002.5	0.099	0.099	2002.4	0.092	0.096	2002.5	0.096	0.098
40-44	1999.9	0.112	0.110	1999.9	0.109	0.106	1999.9	0.111	0.108
45-49	1996.9	0.121	0.122	1996.9	0.118	0.118	1996.9	0.120	0.120
Child									
20-24	2008.5	0.026	0.020	2008.4	0.025	0.019	2008.5	0.026	0.019
25-29	2006.8	0.023	0.023	2006.8	0.023	0.022	2006.8	0.023	0.023
30-34	2004.8	0.028	0.028	2004.7	0.026	0.026	2004.8	0.027	0.027
35-39	2002.5	0.032	0.033	2002.4	0.028	0.031	2002.5	0.030	0.032
40-44	1999.9	0.039	0.038	1999.9	0.037	0.036	1999.9	0.038	0.037
45-49	1996.9	0.044	0.045	1996.9	0.042	0.042	1996.9	0.043	0.043
Under-five									
20-24	2008.4	0.111	0.093	2008.4	0.107	0.089	2008.4	0.109	0.091
25-29	2007.0	0.102	0.103	2007.0	0.101	0.099	2007.0	0.102	0.101
30-34	2005.1	0.116	0.115	2005.1	0.111	0.111	2005.1	0.114	0.113
35-39	2002.8	0.128	0.129	2002.8	0.117	0.124	2002.8	0.123	0.126
40-44	2000.1	0.147	0.144	2000.1	0.142	0.138	2000.1	0.144	0.141
45-49	1996.8	0.160	0.161	1996.8	0.155	0.155	1996.8	0.157	0.158

Figure A-3.1: Infant mortality rates adjusted to a linear equation, 1996 to 2009, males

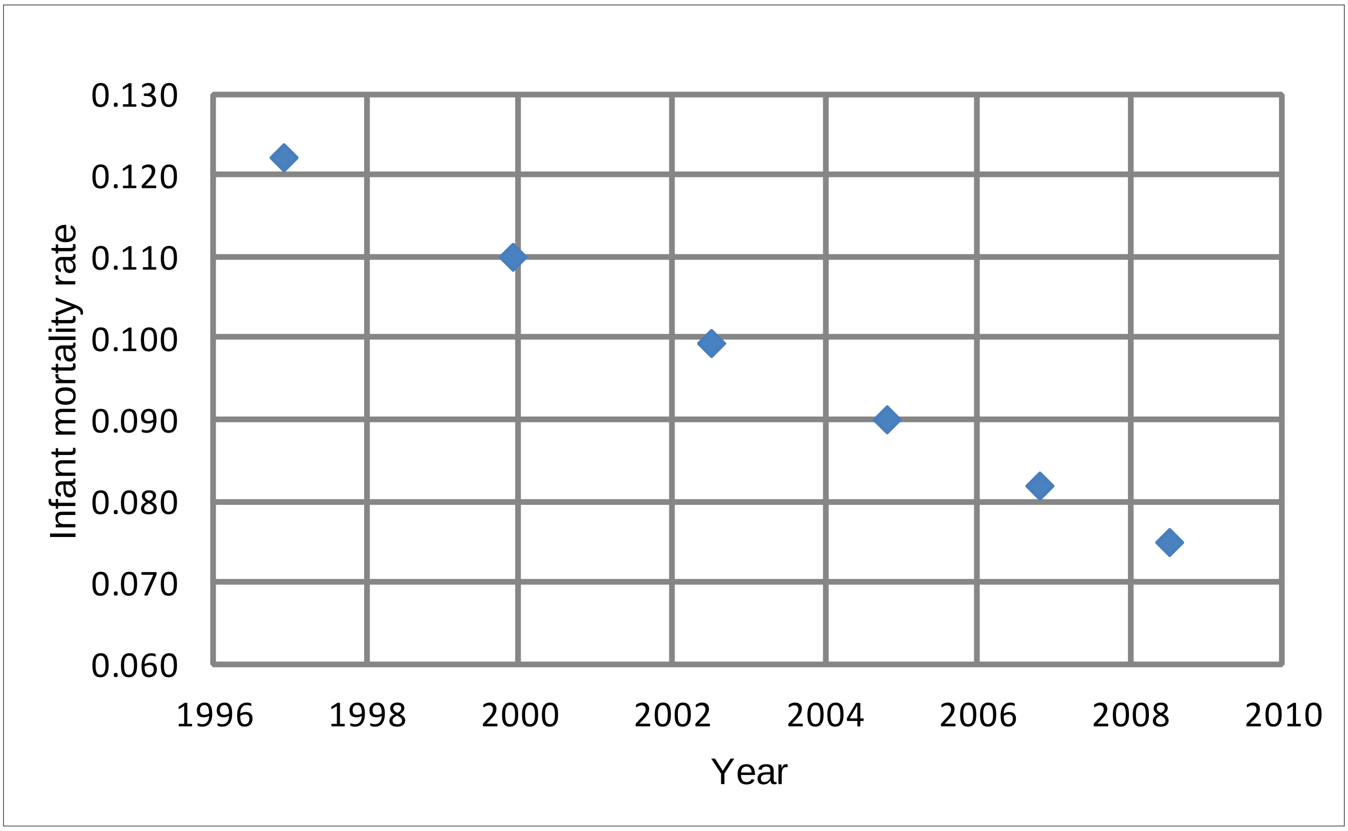


Figure A-3.2: Infant mortality rates adjusted to a linear equation, 1996 to 2009, females

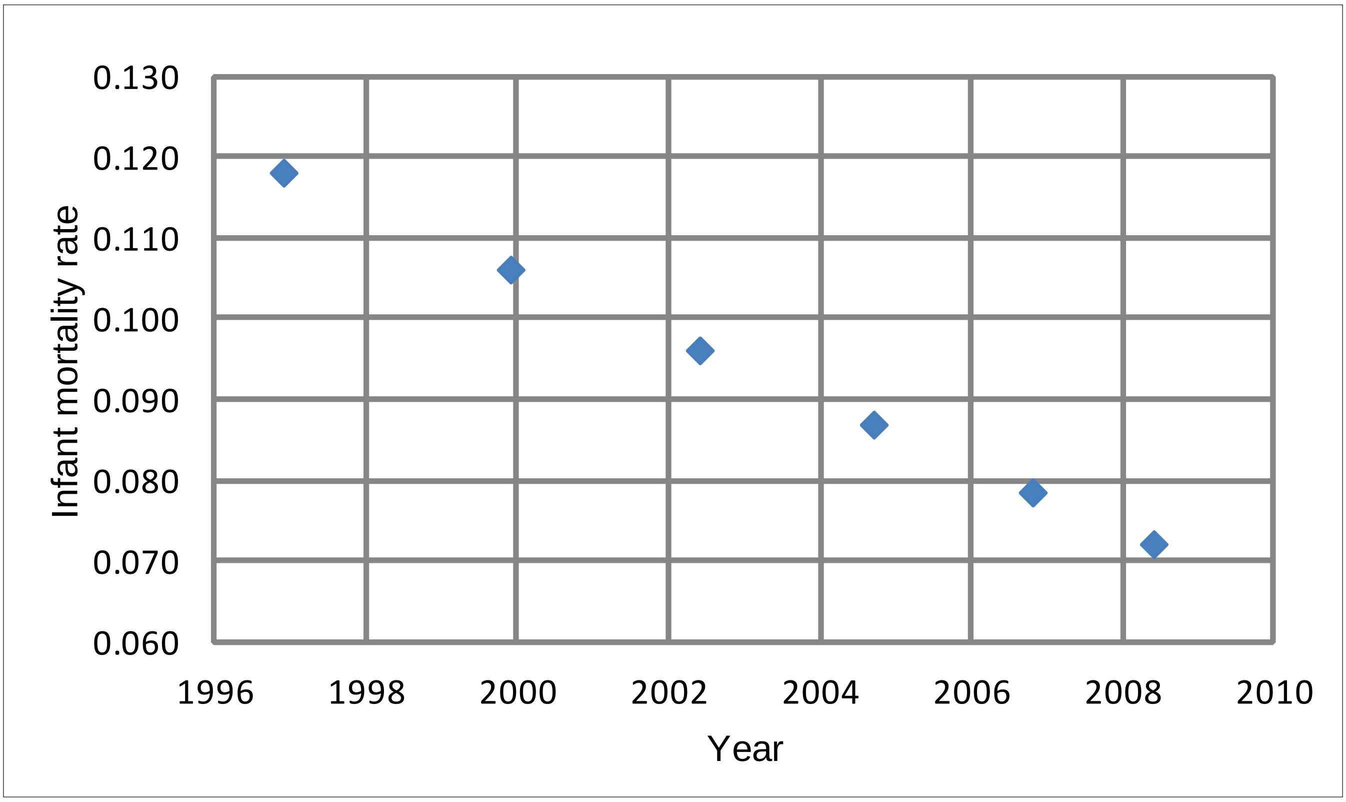


Figure A-3.3: Child mortality rates adjusted to a linear equation, 1996 to 2009, males

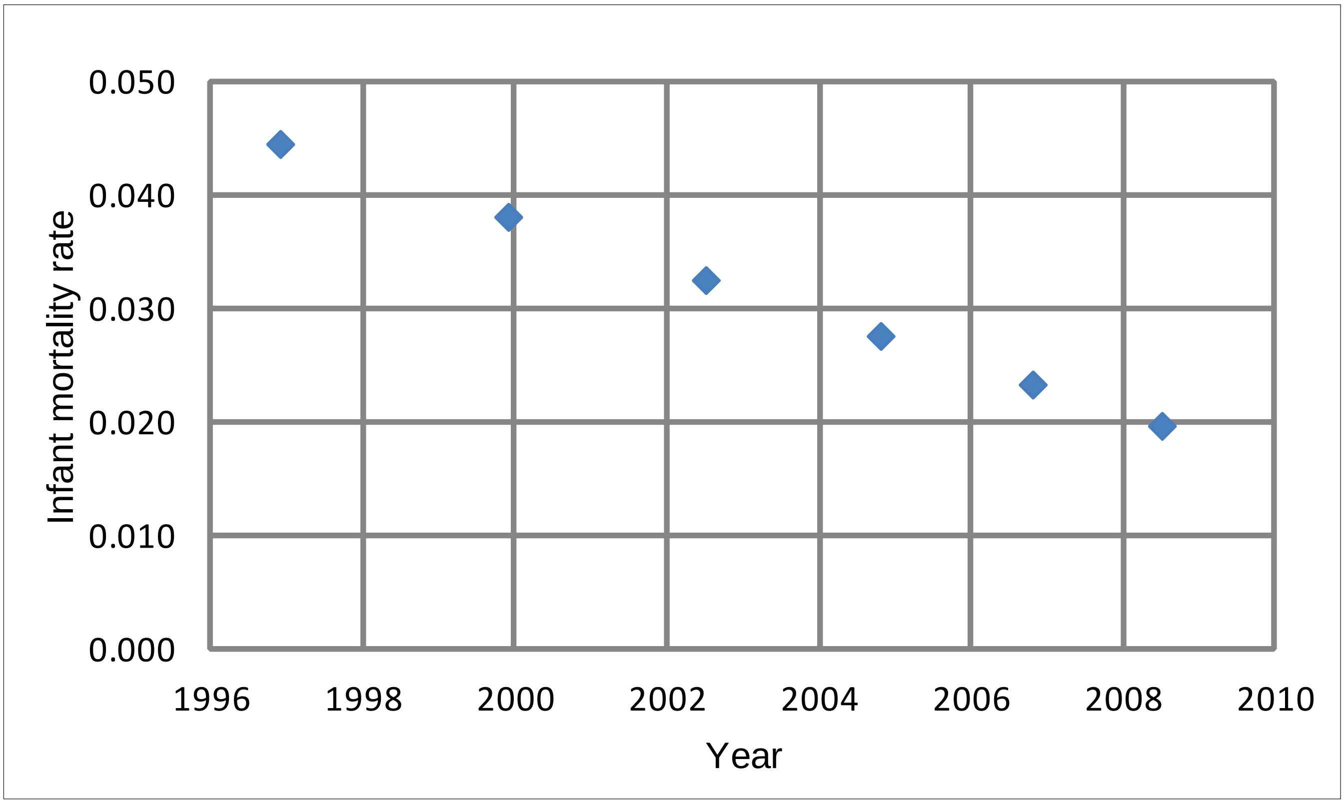
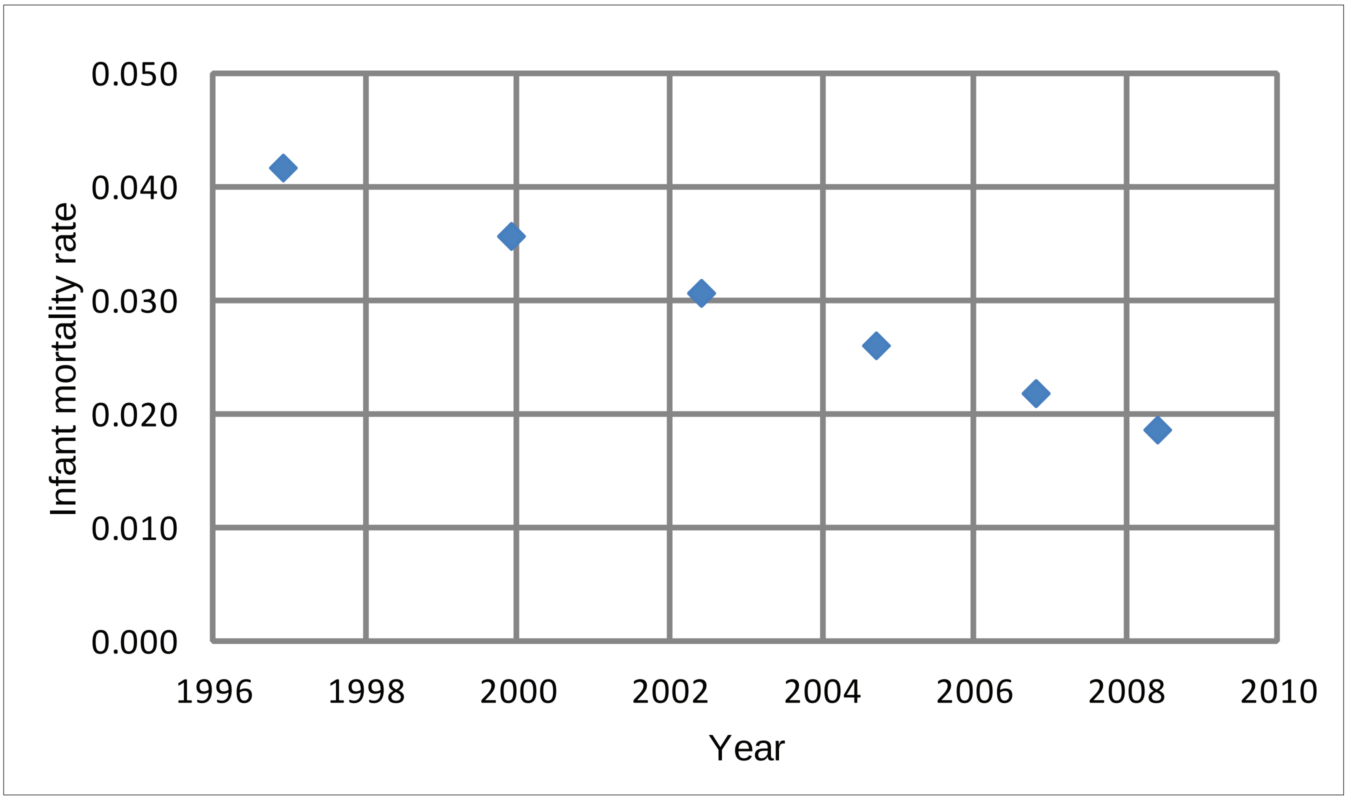


Figure A-3.4: Child mortality rates adjusted to a linear equation, 1996 to 2009, females



APPENDIX B

ADULT MORTALITY AND CONSTRUCTION OF LIFE TABLES

One of the methods to estimate adult mortality is to use data on orphan-hood by age. A question on whether the mother or father of the responded is alive is tabulated by age groups and a relatively sophisticated procedure provides a set of adult probabilities of dying. A similar method uses widowhood as the basis to estimate mortality. The main problem with these methods is that they depend on strict assumptions regarding recent mortality trends, adequate age declarations and, in general, reliable information. In addition, they provide the mortality values for dates relatively distant from the census, usually more than 8 years before. Finally, the evaluation and interpretation of their results could be rather difficult.

During the 2000 and 2010 round of censuses it has become widespread the use of a question on the number of deaths in the household during the past 12 months (by age and sex). With this question, direct estimates of mortality can be obtained. Nevertheless, these values usually have substantial inaccuracies. Infant and child deaths are often severely under-reported and the calculated rates for early ages are absolutely not reliable. Mortality rates corresponding to adults may also be affected by several types of errors. One possible problem is that deaths that lead to the disintegration of households, such as deaths in single person households, are usually unreported. A second frequent problem with this census question is that sometimes people confuse a death in the family with a death in the household. A person who has died in another household is declared as a death in the household because the deceased is a close relative. A third problem is related to errors in the reference period, many reported deaths may not refer to the past year but to a longer or shorter period. A fourth limitation is that age heaping or age exaggeration of the deceased could be frequent. Probably the most important problem regarding this question is the reluctance of respondents to talk about the dead. People do not like to talk of such events, they bring painful memories and they prefer to forget them. In some cultures mentioning a dead person could be even a taboo.

Unfortunately, the rates obtained from the question on death in the household during the past 12 month are almost invariably too low. There are methods to evaluate and adjust the degree of completeness and frequently are successful in adjusting the results (United Nations, 1983; Statistical Institute for Asia and the Pacific, 1994; Hill et all, 2001). However, in some cases the result are too incomplete and unreliable that it is not possible to make any adjustments. Sometimes, in spite of the fact that under-enumeration is so large to be adjusted, the data may suggest a reliable age and sex composition of mortality.

In some cases, the results of the census questions directed to estimate adult mortality are too unreliable or the respective questions are not included. A common practice in those cases is to use infant mortality and model life tables. In a model life table system such as the Coale-Demeny or United Nations, the probability of dying (or any other life table function) at any age uniquely determines a life table within the system, once the pattern has been selected. Therefore, based on an infant mortality estimates a model life table can be selected. Infant mortality contributes to establishing the level of mortality and the selected model life table for the respective age and sex pattern.

The question on deaths in the past 12 months was included in the East-Timor 2010 Census. The question was: *How many members of this household died in the last 12 months* (11 July 2009- to date)? It was clarified that the questions refers to the household and not to a relative who lived in another household. Sex and age of the deceased was also requested. Unfortunately, the data obtained from these questions was not satisfactory.

The analysis of the data started with the calculation of age-specific mortality rates by sex without any adjustment and a subsequent calculation of life tables. The life expectancy at birth obtained from these life tables was 71.2 years for males and 73.1 years for females. These values are too high, especially considering that, according to the 2004 census life expectancies were 57.4 years for males and 58.9 years for females. The large life expectancies at birth strongly suggest an under-enumeration of deaths.

Several methods have been designed to detect and compensate the under-reporting of deaths in census (and registration) data (see Hill et.all 2001). When two successive censuses are available the *Bennett-Horiuchi method* is recommended. This is the case of Timor-Leste (2004 and 2010 censuses). The program BENHR from the demographic computer package Mortpak, (United Nations Population Division, 2003) was used. A description of this method can be found in Mortpak or in the article by Bennett and Horiuchi (1981).

The method estimates the completeness of enumeration or registration for each age group from 5-9 years to the maximum age and also an overall estimate. The number of deaths completeness in the household in the past 12 months was 73.1 percent for males and 85.3 percent for females. These overall results seem quite reasonable. However, completeness by age groups and sex presented substantial variation (they are not detailed in this monograph).

The numbers of deaths were adjusted using the results of the application of the method and new life tables were constructed. These new tables included the infant and child mortality rates estimated on the basis of children ever born and surviving instead of those calculated from the question on death in the household in the past 12 month. This time life expectancies at birth were 67.9 years for males and 71.5 years for females. These values are still too high to be considered as a realistic estimate of mortality in Timor-Leste. It means that in 6 years (from 2004 to 2010) life expectancy at birth increased from 57.4 to 67.9 years among males and from 58.9 years to 71.5 years for females. The increases were 10.5 and 12.6 years, respectively. An increase of this magnitude is very unlikely in 6 years.

The adjustment done by the method was certainly not acceptable. The problem may have multiple origins and a complete analysis to find out the reasons why the corrections did not provide satisfactory results goes beyond the aim of this paper.

As mentioned previously, the census question on number of deaths in the household during the past 12 months may suggest a reliable age and sex composition of mortality in spite of the fact that, even if adjusted, a suitable estimate of the level of adult mortality cannot be estimated. Actually, a further data analysis indicated that the age-specific mortality rates for the adult population obtained from the census fits quite well the North model from the Coale-Demeny system, both for males and females. This analysis was conducted with the program COMPRAR from Mortpak. This program compares an empirical set of age-specific fertility rates to all United Nations and Coale-Demeny model life table patterns and provides indices of similarity for all ages and for ages under and over 10 years of age. According to this program, the age-specific mortality rates obtained from the 2010 Census (adjusted or non-adjusted), for ages over 10 years, were quite similar to the North model of the Coale-Demeny system. It is relevant to note that populations displaying this mortality pattern are very probably subject to endemic tuberculosis, which is precisely the case in Timor-Leste (see National Statistics Directorate, et all, 2010, Chapter 3, Section 3.5). As compared to the other patterns, mortality is higher in the middle age range, from age 10 to 40. Hence, the empirical age-sex mortality pattern in Timor-Leste is similar to the North model at adult ages and to the East model at early ages.

Therefore, three pieces of reliable information were available: infant mortality, child mortality and the fact that adult mortality follows the pattern of the Coale-Demeny North model life table. Using this information, the program COMBIN from Mortpak was used to estimate adult mortality and the respective life tables. This program calculates a life table using three parameters: an estimate of survivorship to age 1, an estimate of survivorship to age 5 and an estimate of life expectancy at age 20 years. The procedure adjusts a designated United Nations or Coale-Demeny model life table to incorporate the child and adult survivorship values given as input.

Table B-1 shows the data utilized as input to the program COMBIN. The survivorships, l(1) and l(5), were calculated directly from the infant and child mortality rates estimated earlier (see Table 1). Life expectancy at age 20 for males and for females were obtained from North model life tables corresponding to infant mortality rates estimated from children ever born and surviving. These model life tables were identified with the program MATCH from Mortpak. The life tables obtained from the three parameters are presented in Table 4 in the main text.

Table B-1; Data for the calculations of life tables with the program COMPRAR

Parameter	Male	Female	Total
Infant mortality, q(0,1)	0.075	0.072	0.073
Child Mortality, q(1,4)	0.020	0.019	0.019
Infant survivorship, l(1)	92485	92795	92654
Child survivorship , l(5)	90661	91072	90879
Life expectancy at age, e(20)	47.3	48.9	48.03
Estimated life expectancy at birth, e(0)	58.72	60.35	59.48

Finally, the mother orphan-hood method, previously mentioned, was utilized to estimate female adult mortality. This method was employed mainly to validate the results obtained by the previous approach. The method uses tabulations on proportion of population with mothers still alive by age group of respondents and average number of children ever born. The program ORPHAN, from the package Mortpak was put to use for the calculations. Results were quite disappointing. According to this method, life expectancy at birth corresponding to year 2001 (the most recent year for which estimates are provided by the method) was 63 males and 71 females years, depending on the life table model adopted for the estimate. These values are too high to be accepted as realistic considering the previous analyses and the 2004 mortality estimates. The method certainly under-estimates adult mortality. In addition, this method provides life expectancy at age 20. The values obtained varied from 52 to 54 years, depending on the model. Once again, these values were too large, suggesting an under-enumeration of adult mortality. No matter the model life table used, these values are too high considering the level of mortality indicated by under-five mortality.

APPENDIX C

MATERNAL MORTALITY

Table C-1 shows the data required to estimate several measures of maternal mortality, the adjusted data and the respective results. The maternal mortality measures presented in the table are:

- MMR (per 100,000 live births) = Number of maternal deaths by 100,000 live births during a given period, usually a year;
- Proportion of deaths due to maternal causes = Ratio between the number of maternal deaths and the number of deaths among women of reproductive age;
- MM Rate (per 1,000 women) = Number of maternal deaths per 1,000 women in reproductive age (15-49);
- Lifetime risk of maternal deaths =Chances of a woman dying from maternal causes over the course of her 35 years reproductive life span.

Table C-1: Calculation of total and age-specific maternal mortality ratios (per 100,000 births)

Age at Death	Women population	Maternal deaths	Obseved total deaths	Adjusted total deaths	Adjusted maternal deaths	Adjusted births	MMR (per 100,000 live births)	Proportion of deaths due to maternal causes	MM Rate (per 1,000 women)	Lifetime risk of maternal deaths. 1 in:
15	57,781	17	73	165	38	3,703	1,037	0.23	0.66	3
20	47,091	28	86	172	56	10,497	534	0.33	1.19	6
25	38,567	21	80	163	43	10,741	402	0.26	1.11	6
30	26,106	8	46	126	22	6,311	352	0.17	0.84	4
35	27,547	21	73	154	44	5,855	754	0.29	1.60	8
40	22,965	6	76	153	12	2,489	483	0.08	0.52	3
45	18,487	8	74	141	15	958	1,589	0.11	0.81	4
Total	238,544	109	508	1075	231	40,554	570	0.21	0.97	34

United Nations, Department of Economic and Social Affairs. Population Division World Mortality 2011

www.unpopulation.org

As discussed and demonstrated in the previous chapter, the number of deaths in the household during the year preceding the census, is under-enumerated. Therefore, the first operation was to adjust the total number of deaths. This was done by applying the age-specific mortality rates from the female life table (Table 4) to the female population. The life tables presented in Table 4 indicates the mortality already adjusted. The results of this operation are presented in the respective column in Table C-1.

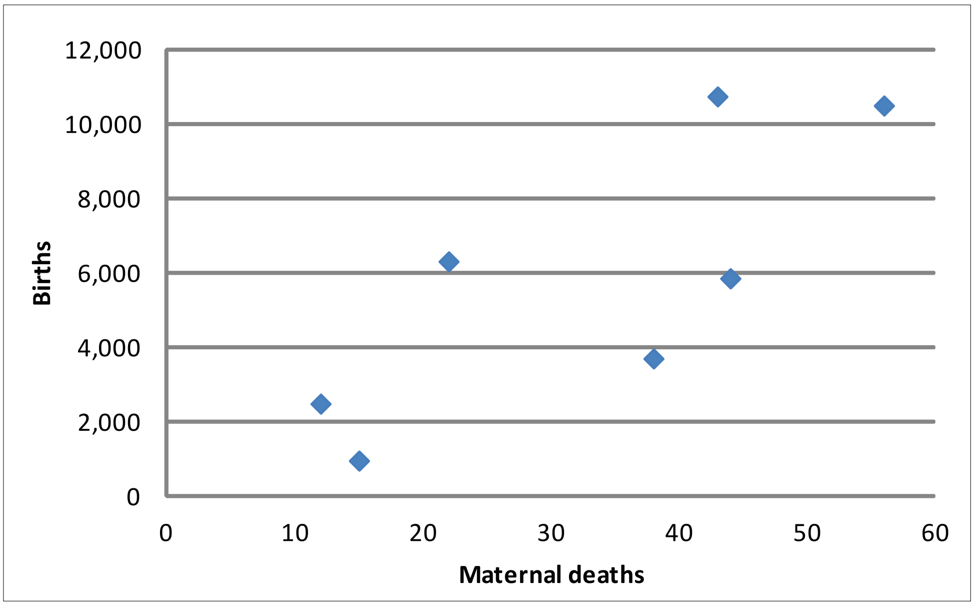
The second was to adjust the maternal deaths presented in the third column in the third column in Table C-1. The observed maternal deaths were increased in the same proportion as the overall mortality was increased. For example, there are 73 enumerated deaths among the female population 15 to 19 years and it was increased to 165 deaths by the overall adjustment, which corresponds to an increase of 126 percent. This same increase was applied to the observed maternal deaths (73) and the result is 38 maternal deaths. The total number of enumerated deaths was 109 but after the adjustment it was 231 maternal deaths.

Table C-1 also includes the adjusted number of deaths. This information comes from an indirect estimate of fertility conducted with the 2010 census data using the own-children method. The method and data are presented in Fertility and Nuptiality Based on the 2010 Timor-Leste Population and Housing Census (reference).

With the previous information four measures of maternal mortality were estimated: MMR (570 maternal deaths per 100,000 births), proportion of deaths due to maternal causes among women in reproductive ages (0.21 or 21%), MM Rate (0.97maternal deaths per 1,000 women) and the LTR (1 in 33.7). In addition to the total, the table shows the respective values of each 5-year age group of women in reproductive age.

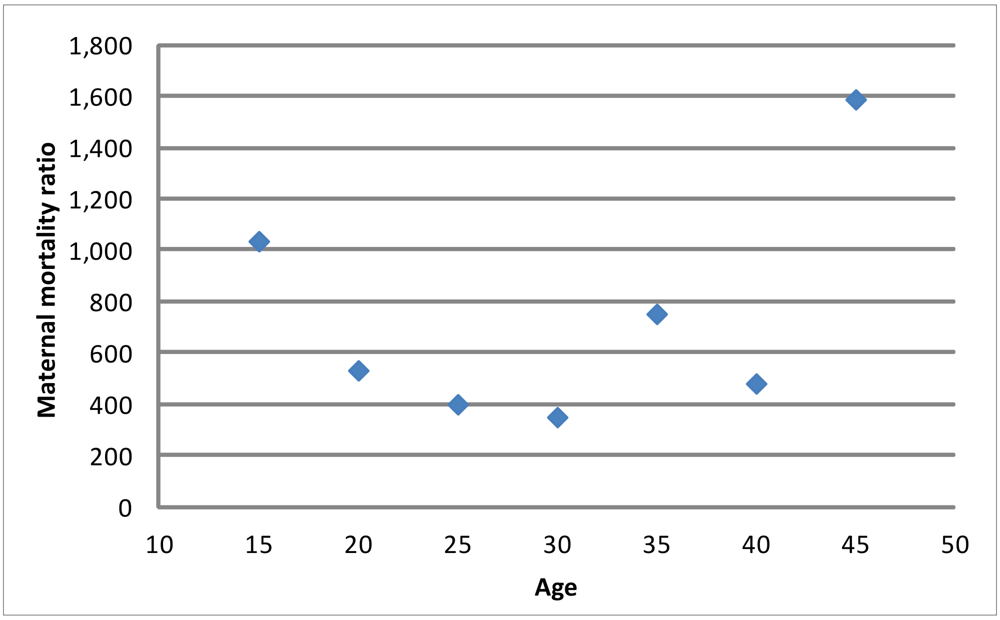
Given the absence of formal methods for adjusting maternal mortality measures, an evaluation is convenient. Given that the risk for a maternal death is a pregnancy, the proportion of deaths that are maternal should be directly related to the number of births. Figure C-1 shows the scatter plot of births and maternal deaths by age groups. In general, there is a positive association between the two, although there is a large amount of scatter also.

Figure C-1: Scatter plot of births and maternal deaths by age groups, 2009



Maternal mortality ratios are expected to show a "J" shaped distribution by age, reflecting the higher risks at younger and older ages. Figure C-2 shows the pattern of maternal mortality ratios by age group. Again, the pattern is consistent with expectations, with the ratios rising sharply with age of woman (except for a problem for women aged 35-39). it is interesting to note however that the ratios for women under age 20 are the second highest of all, suggesting that early childbearing is a major risk factor in the Timor-Leste case; only childbearing over age 45 exhibits a higher risk.

Figure C-2: Maternal mortality ratio by age, 2009



Although this evaluation of the data quality is by no means rigorous and systematic, it suggests that there is no evident reason for serious concern about maternal mortality data quality in the 2010 Census. To the extent that adequate adjustment instruments are used, maternal mortality estimates appear reliable.

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