# DETERMINANTS OF INFANT MORTALITY IN TURKEY

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This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

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# ABSTRACT

DETERMINANTS OF INFANT MORTALITY IN TURKEY

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Infant mortality rate is used as an indicator of a nation's economic welfare. Despite the tremendous reduction since 1900s infant mortality rate is still high for developing countries. Infant mortality is reduced from 67 to 21 per 1000 live births in 17 years from 1990 to 2007 in Turkey. However, IMR in Turkey is still much higher than the rates in developing countries which is reported as 5 in 2007. In this thesis, I examine regional, household and individual level characteristics that are associated with infant mortality. For this purpose survival analysis is used in this analysis. The data come from 2003-2004 Turkey Demographic and Health Survey that includes detailed information of 8,075 ever married women between the ages 15-49. 7,360 mothers of these women gave birth to 22,443 children. The results of the logistic regression show that intervals between the births of the infants are associated with infant mortality at lower levels of wealth index. Children from poorer families with preceding birth interval shorter than 14 months or children whose mothers experience a subsequent birth fare badly. Breastfeeding is important for the survival chance of the infants under the age 3 months. Place of delivery and source of water the family uses are also found to be correlated with infant mortality risk. Curvilinear relation between maternal age at birth and infant mortality risk is observed, indicating higher risk for teenage mothers and mothers having children at older ages.

**Keywords:** Infant Mortality, Turkey, Survival Analysis, Logistic Regression

# ÖZ

TÜRKİYE'DE BEBEK ÖLÜMLERİNİ BELİRLEYEN FAKTÖRLER

Seçkin, Nutiye

Yüksek Lisans, İktisat Bölümü
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Bebek ölüm oranı ülkelerin ekonomik gelişmişliklerini ölçmek için kullanılan göstergelerden biridir. Bu oran 1900'lü yılların başından bu yana büyük oranlarda azalmış olmasına rağmen özellikle az gelişmiş ve gelişmekte olan ülkeler için hala oldukça yüksektir. Türkiye'de 1990 yılında 67 olan oran 2007 yılına gelindiğinde 21'e geriledi. Bu ülke için önemli bir ilerlemeyi işaret etse de Türkiye'de bebek ölüm oranı hala gelişmiş ülkelerde 5 olan oranın oldukça üzerindedir. Bu tezdeö Türkiye'de gerçekleşen bebek ölümleri ve bölgesel, ailesel ve bireysel özelliklerin arasındaki ilişki incelenecektir. Çalışmanın ekonometrik hesaplama kısmında süre analizi metotları kullanılacaktır. Kullanılacak veri tabani Hacettepe Üniversitesi tarafından yürütülen Türkiye Nüfüs ve Sağlık Araştırması Anketinin 2003-2004 yılı versiyonu olacaktır. Bu ankette yer alan yaşları 15 ile 49 arasında, en az bir defa evlenmiş olan 8.075 kadının 7.360'ı çocuk sahibidir. Bu kadınlar toplamda 22,443 çocuk doğurmuşlardır. Çalışmanın sonuçları doğum aralıklarının yoksul ailelerde bebek ölüm riski ile ilişkili olduğunu göstermaktedir. Bir önceki kardeşle arasındakı yaş farkı 14 aydan daha kısa olan ya da annesi kendisinden sonra bir doğum daha gerçekleştirmiş yoksul ailelerden gelen çocukların ölüm riski diğer çocuklarla kıyaslandığında daha yüksek. Anne sütü bebeğin hayatının ilk 2 ayında ölüm riski ile ilişkilidir. Bunların dışında, doğumun yapıldığı yerin ve ailenin kullandığı suyun kaynağının da bebeğin hayatta kalma şansı ile ilişkili olduğu sonucuna ulaşılmıştır. Annenin doğum sırasındaki yaşı ve bebek ölüm riski arasında genç ve ileri yaşta anne olanların daha yüksek bebek ölümü riski taşıdıklarını belirten egrisel bir ilişki bulunmuştur.

**Anahtar Kelimeler:** Bebek Ölümü, Türkiye, Süre Analizi, Lojistik Bağlaşım

***To My Parents***

***and***

***To My Love Erman***

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# CHAPTER 1

# INTRODUCTION

## 1.1 Overview

The rate of infant mortality is an important indicator of nations' socioeconomic welfare. Tremendous reduction in infant mortality rate took place since 1900s. Despite this reduction, infant mortality rate (IMR) – the probability, expressed as a rate per 1,000 live births, of a child born in a specified year dying before reaching the age of one – is still high especially in less developed countries. According to the data of Millennium Development Goals Indicators collected by the United Nations, IMR in 2007 at world level is 47; this rate is 5 for developed regions whereas 51 for the developing countries (*Millennium Development Goals Indicators* 2009). Therefore, it is important to understand the determinants of infant mortality and knowledge of these factors received great attention by economists, demographers and biometricians.

Like most of developing countries, Turkey experienced declines in IMR. Infant mortality is reduced from 67 to 21 per 1000 live births in 17 years from 1990 to 2007. Moreover, according to the results of the survey conducted by Hacettepe University Institute of Population Studies infant mortality rate in 2003-2008 is 17.6 per 1000 live births in Turkey. This implies a substantial progress in terms of IMR. However, IMR in Turkey is still much higher than the rates in developing countries. Due to this high rate of infant mortality Turkey is demographically unclassified. Socio-economic indicators of the country contradict with rate of mortality of children under 1. The reasons of this high rate remain mostly unknown. IMR is in Turkey is higher than the IMR in countries having similar adult mortality rate and income per capita with Turkey (Behar et al. 1999; Gursoy-Tezcan 1992; Aksit 1989). Doctors, demographers and sociologist attempt to determine the factors causing this puzzle. However, to the best of my knowledge no attempt has been previously made by economists to analyze the determinants of infant mortality in Turkey.

## 1.2 Aim and Scope of Thesis

The main aim of this study is to examine the factors that are correlated with the mortality among the children under the age one. Moreover, interaction of wealth and some explanatory variables will be used in order to observe the differentiated effects of the factors among people from different socioeconomic groups. In Turkey, most of the infant mortality cases occur suddenly after the birth of the child. Therefore, correlations of specific factors with infant mortality risk are analyzed at different stages of infants' lives.

The relation between the factors that are affected by the policies implemented in the country and infant mortality risk are underscored. In this way, this study intends to detect the steps required to take in order to decrease IMR – used as an indicator of social health and economic wealth.

Data from Turkey Demographic and Health Survey (TDHS) conducted by Hacettepe University Institute of Population Studies in 2003-2004 is used in this study. Instead of the birth histories of the women, information about mother, mother's partner, child and housing characteristics are presented in the data.

In this study, the regional, household and individual level factors associated with infant mortality in Turkey are examined. For this purpose the survival analysis, which models time to event data, is thought to be appropriate method to be used. This is because using survival analysis prevents the right censoring and truncation problems caused by the nature of the data and allows including time varying variables to the model.

Researches analyzing the determinants of infant health in Turkey used a limited set of variables. Impact of consanguineous marriages on infant mortality was studied by doctors frequently. Studies conducted to examine the factors affecting infant health in developed and developing countries using an extended set of explanatory variables are also rare. Hence, this thesis which attempts to analyze the determinants of infant mortality risk in Turkey – a developing country – using a varied set of explanatory variables makes a contribution to the literature in this context.

## 1.3 Outline of Dissertation

The structure of this thesis follows the order in which the work was undertaken in response to the aims as they were initially conceived. It consists of 5 further chapters.

Chapter 2 provides a brief review of the literature. The variables used frequently by the researchers as determinants of infant mortality are summarized. The expected impacts of these variables on infant mortality risk are described in the light of the studies conducted both for developing and developed countries. Moreover, literature on infant mortality in Turkey will be summarized briefly.

In Chapter 3, data used in this study is presented.

Fourth chapter focuses on the estimation method used in this study. The shortcomings of data and the way which survival analysis handles these problems are described.

Chapter 5 illustrates the results of the estimations run in order to identify the determinants of infant mortality in Turkey. The comparisons between the existing studies are also given in this chapter.

Finally, Chapter 6 summarizes the work done within the scope of this thesis and discusses the conclusion drawn from the study conducted. It also addresses further recommendations for the similar researches that are intended to be carried on.

# CHAPTER 2

# LITERATURE SURVEY

Infant mortality is one of the most important indicators of nations' economic development. Thus, determinants of infant mortality received considerable attention from researchers of different fields like biomedical, demography and economy for a long while. These researchers investigate the impact of very different variables on infant mortality. As Wolpin (1997) claims, this is mostly due to the difficulties in determining the variables to be included in the model and partly due to the data limitations used in the studies.

In this chapter of the study, first variables which are commonly used in the studies conducted are discussed. The possible ways they affect the risk of infant mortality, the difficulties in measuring these variables, the problems caused by including them in the model and how these problems are dealt by researchers from different fields are explained. Then, the literature on determinants of infant mortality in Turkey will be summarized briefly.

## 2.1 International Literature on Infant Mortality

### 2.1.1 Breastfeeding

Breastfeeding is claimed to improve infant health thanks to three characteristics it has. First, it is nutritious; it can provide all the nutritional requirements for an infant up to six months. None of its substitutes is as rich or as complete as mother's milk. Second, breast milk provides immunity to infections. Third, breast milk is clean and hygienic since the substances it includes prevent the growth of bacteria (Palloni and Tienda 1986).

Given these properties the size of the progressive effects of breastfeeding on infant health may depend on the age of the infant and the family's socio-economic status.

1) Mother's milk as a nutrient: As the child ages, milk becomes less sufficient to meet all the nutritious requirements for the infant. Also, in cases where the substitutes of breastfeeding are scarce the significance of breastfeeding increases (Palloni and Tienda 1986).
2) Breastfeeding to improve immunity: For infants with a higher risk of being infected breastfeeding is more effective in improving health (Palloni and Tienda 1986). Breastfeeding prevents infants to be subject to infected water and food.
3) Mother's milk as a hygienic food: Breastfeeding has stronger effects when hygienic conditions are not met. It is claimed that the harmful effects of inadequate water and sanitation should be less the longer breastfeeding lasts (Davanzo and Habicht 1986).
4) And through all these properties in the lack of medical services and information breastfeeding is more progressive for the health of the infant (Palloni and Tienda 1986).

There are some problems in measuring the effects of breastfeeding on infant health. First, in some cases breastfeeding do not start at all due to the death of the infant immediately after birth. This is the case of reverse causality; death is the reason for no breastfeeding, not the outcome of it. Second, breastfeeding may be truncated. Truncation occurs because the duration of breastfeeding cannot be longer than the duration of life. If the child dies before he/she is weaned, the observed duration of breastfeeding will be shorter than the case where the child lived. Even though actual impact of breastfeeding on infant mortality is zero, the truncation problem makes it seem as if shorter durations of breastfeeding cause shorter duration of life. This leads the effect of breastfeeding to be underestimated because of truncation (Wolpin 1997).

In the literature several ways are used to overcome the problem of truncation. Olsen and Wolpin used the average duration of breastfeeding of the children within the same family who survived at least 24 months as a proxy for the breastfeeding of children who died before being weaned. They claim this measure to be the unbiased estimate of desired breastfeeding. This would be true only if the inputs are uncorrelated with the child specific frailty. In case of correlation between breastfeeding and child specific frailty duration of desired breastfeeding will be peculiar to each child in the family (Olsen and Wolpin 1983). Palloni and Tienda used another strategy to overcome the truncation problem. They predicted the chance of survival of the index child in small age segments (x, x+n) as a function of whether or not the child is breastfeed up to age x. By doing so, they compare survival chances of children only living up to certain age (x) as a function of breastfeeding. The duration is truncated in the same way for survivors and non-survivors (Palloni and Tienda 1986). This method is used also used by Pebley et al. and Rosenzweig et al. in their studies (Pebley and Stupp 1987; Rosenzweig and Schultz 1983a). This helped to deal with the problem of truncation; however the shortcoming of method is to measure breastfeeding less than the true duration. In spite of the shortcoming of this method, it is also preferred in this study to deal with truncation of breastfeeding since it seemed the most proper method to be used with the data we have. Breastfeeding and the length of the infants' lives are measured in months. Age segments are taken as time between two consecutive months, (x, x+1). And the survival chance of the infant is estimated as a function of dummy variable which takes value 1 if the child is reported to be breastfed at least as long as x months and 0 otherwise.

Other ways to treat truncation problem are estimating a structural model in which breastfeeding is one of the decision variables, assuming a particular structure corresponding to behavioral technology or using instrumental variables that move parallel with breastfeeding but do not have direct effect on infant mortality (Wolpin 1997).

Finally, a problem arises in the existence of unobserved frailty and dependence of breastfeeding on this frailty. The impact of breastfeeding on child survival will be biased if there are some factors unobservable to researcher but known by the family both affect infant survival and breastfeeding. If the families have incentives to breastfeed weaker children, the effect of breastfeeding will be underestimated.

The literature on the determinants of infant mortality indicates a positive correlation between the cessation of breastfeeding and infant mortality risk (Palloni and Tienda

1986; Rosenzweig and Schultz 1983a; Pebley and Stupp 1987; Olsen and Wolpin 1983; Murphy and Wang 2001; Guilkey and Riphahn 1998). Moreover, Jatrana finds the utilization of colostrums as the most important factor influencing infant mortality in a less developed region of India, Mewat (Jatrana 1999). However, Wolfe and Behrman (1982) could not find a stable relationship between breastfeeding and child health which they measure using child mortality, standardized weight, standardized height and standardized biceps circumference.

### 2.1.2 Prenatal Care

Empirical studies indicate that increased use of prenatal care results in better health of infants.

In the estimation of the effects of prenatal care problems similar to those of breastfeeding arise. First, prenatal care may be endogenous. If women who experience problematic pregnancies receive more prenatal care, ignoring this adverse selection may lead to an underestimation of the effect of prenatal care on birth outcome. On the other hand if women who receive prenatal care have strong preferences for healthy children and practice other form of healthy behavior, the endogeneity problem may lead to over estimation of the impact of prenatal care on birth outcome. The evidence of adverse selection is found in the literature, which means women who are unhealthy initiate prenatal care earlier (Rous et al. 2004; Maitra 2004). Rosenzweig and Schultz also claim that not accounting for heterogeneity leads an underestimation of the effect of prenatal care on the birth weight of infant (Rosenzweig and Schultz 1983b). And birth weight is thought to be highly correlated with infant mortality (Cramer 1987; Solis et al. 2000).

In addition to the behavioral reasons, there may also be non-behavioral reasons of unobserved frailty. This may appear when frailty causes fetal wastage. Only the fetuses that are healthier will have chance to survive to later stages of gestation. Thus prenatal care which is initiated in the later stages of gestation may lead to lower infant mortality, since these fetuses will be healthier in the sense that they survived to that period of gestation. In addition to these probable claims, the effects of prenatal care may be underestimated if starting prenatal care earlier evokes unhealthy fetuses to born alive that otherwise would not (Wolpin 1997).

Some studies use TSLS method in order to deal with endogeneity problem (Jewell and Triunfo 2006; Rosenzweig and Schultz 1983a). TSLS involves estimation of endogenous variables on variables chosen to be used as instruments. In order to be a valid instrument a variable has to be correlated with the endogenous explanatory variable and it also has to be uncorrelated with unobserved frailty. In the second stage of the method the variable in consideration is regressed on exogenous variables as well as on fitted values of endogenous variables obtained by the first stage regression. Using data of poor women in Uruguay, Jewell and Triunfo find that higher usage of prenatal care will result in increased birth weight which in turn will increase child health (Jewell and Triunfo 2006). Rosenzweig and Schultz, using US data, find that delay in prenatal care considerably increase infant mortality risk (Rosenzweig and Schultz 1983a).

Maitra and Rous et al. use a full-information maximum likelihood estimation approach not only to deal with endogeneity problem but also to control for the potential biases of sample selection. Sample selection takes place when the women who decide to give birth are not a random sample of pregnant women (Rous et al. 2004; Maitra 2004). Rous et al. claims that, in the literature there is evidence of higher incentive to give birth rather than abort when child is expected to be healthy, named positive fetal selection (Rous et al. 2004).

Maitra (2004) estimated the demand for health inputs, prenatal care and hospital delivery, and infant mortality jointly. By doing so, he accounts for unobservable endogeneity and self-selection. According to this study, the demand for health inputs is related to relative power of the parents. He states that bargaining between parents cannot directly affect infant health but it affects the demand of health inputs, which in turn affects child health. The results of the study imply that woman's education has a stronger effect on health care usage relative to that of her husband and a woman's control over resources has a significant positive effect on demand for prenatal care (Maitra 2004).

The second problem of estimating the impact of prenatal care is that the duration of prenatal care is truncated above by the duration of gestation. Prenatal care is strongly correlated with the length of gestation duration. Provided that there are omitted variables which affect infant mortality through gestation length, prenatal care will be correlated with infant mortality. This will also be the case even in fact there is no relationship between infant health and prenatal care. In this case, ignoring the truncation problem will result in incorrect estimates of effect of prenatal care (Wolpin 1997).

Prenatal care is commonly measured as the month of initiation of prenatal care. Jewell and Triunfu uses this to measure prenatal care (Jewell and Triunfo 2006). However Rous et al. use the number of doctor visits as a measure of prenatal care, which is also a usual way to measure (Rous et al. 2004). On the other hand, Maitra uses prenatal care as a binary variable, whether the women attained prenatal care or not (Maitra 2004).

### 2.1.3 Previous Birth Interval

Another variable that is accepted to be in correlation with infant survival is the interval between the previous birth and the child that is considered. There is a general thought that longer birth intervals improve the survival chance of the following infant (Bhalotra and van Soest 2008; Majumder et al. 1997; Davanzo and Habicht 1986; Koenig et al. 1990; Pebley and Stupp 1987; Murphy and Wang 2001). Short preceding birth interval influences infant mortality through three mechanisms. First, closely spaced births cause depletion of the mother. Second mechanism is through sibling competition and the third is transition of infectious diseases between the closely spaced children (Majumder et al. 1997). The first one is the biological and the other two are behavioral effects of short preceding birth interval (Koenig et al. 1990). Maternal depletion occurs as a result of repeated and closely spaced pregnancies. Closely spaced pregnancies do not give the mother enough time to recover from the adverse physiologic and nutritional demands related to pregnancy (Koenig et al. 1990). The child who is born in such an environment suffers from low birth weight, short duration of gestation and growth retardation (Majumder et al. 1997). This mechanism is effective in the early stages of life (Koenig et al. 1990). Competition mechanism appears since the scarce resources of the family, including maternal care have to be divided between the siblings at closer ages. The significance of the effect competition on child mortality changes as the child ages and according to the level of resources available to the family (Palloni and Tienda 1986). The ease of the transition of infectious disease and severity of infection in the families with higher number of children reveals the third mechanism (Koenig et al. 1990).

The length of the preceding birth interval and infant mortality are highly correlated. But it will be misleading to look at the impact of the duration of the preceding birth interval unless the survival status of the previous child and duration of breastfeeding are not controlled. First, women who tend to breastfeed their children shorter are likely to have shorter birth intervals due to the shorter suppressing effect of lactation on fecundity. Since the children who are breastfed shortly are more likely to die, the relationship between the short preceding birth interval and infant mortality may be spurious (Pebley and Stupp 1987). Second, with the death of a child breastfeeding is cut off, which gives way to conception and shortens the birth interval. Or alternatively replacement and hoaring effects may be the reason of short birth interval after the death of a child. Strong intra family correlation states the dead of the previous child is a predictor of the survival of the index child, therefore this may also cause a spurious relation between preceding birth interval and child mortality.

Studies diverge in the way they define previous birth interval. Most of the studies define it as the inter birth interval, some as inter conception interval, some as birth to conception interval (Rosenzweig and Wolpin 1995), and the others as average birth interval (Koenig et al. 1990). These definitions may result in different interval lengths, since premature births and stillbirth are probable. If inter birth interval is used as a definition of previous birth interval a short interval may be the result of premature birth, whereas a long interval may imply miscarriage or stillbirth. The problem of premature birth may be dealt by avoiding intervals shorter than nine months; however miscarriage and stillbirth are difficult to identify. This would be a problem if miscarriage and stillbirth are correlated with infant mortality. Ignoring miscarriage and stillbirth may result in underestimating the effect of preceding birth interval on infant mortality (Bhalotra and van Soest 2008).

The literature on the determinants of infant mortality also differentiates by the way researchers treat the preceding birth interval of the first child, who is not preceded by any birth. In their article Olsen and Wolpin (1983) take the length of preceding birth interval as zero and claim that the effect of average preceding birth interval (effect of previous birth interval times average birth interval) should be added to the effect of the being first child (Olsen and Wolpin 1983). On the other hand, in order to evaluate the impact of the previous birth interval on infant mortality some studies choose to exclude first births from the data used (Koenig et al. 1990; Majumder et al. 1997; Omariba et al. 2007b). Some studies take the first births as if they are in the most favorable group, the group with the longest previous birth interval (Palloni and Tienda 1986). One other possibility is to code a set of dummy variables for the previous birth intervals and first birth (Pebley and Stupp 1987; Murphy and Wang 2001; Miller et al. 1992).

### 2.1.4 Succeeding Birth Interval

Short subsequent birth interval is found to influence child survival adversely in various studies. Explanations about the ways it affect child mortality are similar to those given for the short previous birth interval except maternal depletion. Competition mechanism operates since some of the resources including parental care go to the new born child and less is left for the index child. Also mother may decide to stop breastfeeding because of the beginning of a pregnancy; this would imply an indirect competition (Koenig et al. 1990).

There may be spurious relation between death of the index child and following birth interval. Cut of breastfeeding or replacement and hoaring effects after the death of a child may lead to fertility. In case of the index child's dead, the shorter following birth interval will not be the reason of the death, but the outcome of it. In order to deal with reserve causality some studies take only the subsequent births that occur before the beginning of an age interval. Survival of the child in a small age interval (x, x+n) is estimated as a function of whether conception occurred before the child entered to the age segment (Pebley and Stupp 1987; Palloni and Tienda 1986).

Using the data of Peru, Palloni and Tienda estimated the impact of inter-birth intervals and breastfeeding on infant and child mortality. According to them the effects of the following birth interval will be visible after three months child is born and will be stronger if the family resources of the family are scarce. They also suggested that the advantage of long following birth interval will be significant even in the early childhood when succeeding birth interval will be effective through the competition effect. The results of their study support these suggestions. They find that short intervals between births result in high mortality risk for the children until the age two (Palloni and Tienda 1986).

In their article Bhalotra and van Soest mention a problem named death trap. Death trap occurs when the death of a child shortens the interval to the next birth and shorter previous birth interval increases the mortality risk of the next child. They find the evidence of death trap in the raw data of India (Bhalotra and van Soest 2008). They also claim that the interventions to reduce child mortality or lengthen birth interval would have multiplier effects on infant mortality, since these would also affect birth spacing and fertility and indirectly infant mortality again.

Instead of the succeeding interval length (Olsen and Wolpin 1983) used number of alive children in the family by age. They also included the number of rooms in the house. These variables were included in order to measure the disease environment. Instead of number of the rooms and children in the house source of water used by the family is included to the analysis in this study as a proxy for the environment where the child grows up.

### 2.1.5 Maternal Age at Birth

The impact maternal age at birth draws attention of many researchers studying determinants of infant and child mortality. General notion is that; unfavorable effect of teen maternity on infant mortality is related to reproductive immaturity of mother. Most of the studies investigate a curvilinear relationship between the maternal age at birth and infant mortality, high risks having infant mortality at very young and old ages (Bhalotra and van Soest 2008; Maitra 2004; Geronimus 1986).

The impact of maternal age at birth on infant mortality can be interpreted as a biological impact only if all the inputs and child specific frailty endowment are controlled (Wolpin 1997). Otherwise, the effect will include the impact of other behavioral and non-behavioral factors that influence both infant mortality and maternal age at birth. This is because women who bear child at a very young age mostly are not randomly selected from a population of mothers. Adolescent mothers usually come from a socioeconomically disadvantaged group. Geronimus (1986) finds that teenage mothers are generally black, rural residents and receive inadequate prenatal care in United States (Geronimus 1986).

Maitra and Pal (2007) claim that teenage mothers are more likely to be drop outs from school, do not have steady jobs and have financial problems. They find that adolescent mothers use health inputs differently from all other women. Also they find evidence of self-selection in using health inputs. Ignoring the self-selection biases the estimates of the effects of early child bearing on infant mortality. After eliminating the unobserved heterogeneity the adverse effect of teenage maternity disappears. If adolescent mother are provided adequate health input the negative impact of early child bearing can be reduced (Maitra and Pal 2007).

### 2.1.6 Mother’s Education Level

Maternal education is an important determinant of infant and child mortality and is mostly used as a proxy for socio-economic status of mother. Less educated mothers are found to experience more child mortality (Murphy and Wang 2001).

There are several explanations made for the ways which maternal education influences child health. More educated women adopt simple health knowledge contrary to fatalistic acceptance of health outcomes; they adopt alternatives in child care and recent treatments. They can feed their children and practice child care more appropriately. Educated women are more capable of handling modern world. Communication with doctors and nurses should be easier for educated women. Educated women may change traditional balance of family relationships. In different countries education may have an effect over child health through a different channel (Caldwell 1979). Also educated mothers may use health inputs more productively and effectively, may have better information of best allocation of health inputs, may have more family resources in consequence of marrying wealthier men or working outside, and may have different preferences for child health. All these may improve child health. However more educated women may assign more value to their time and may spend less time with their children, which would lead to poorer infant health (Schultz 1984).

In another study conducted by Hobcraft, the survival chances of children born to educated mothers are argued to be greater due to several demographic reasons. Educated mothers tend to marry and have children later and have fewer children; therefore the excess risk of infant mortality for teenage mothers is reduced. Also educated mothers experience lower maternal mortality and per birth maternal mortality because of greater usage of health services, avoiding risky pregnancies and of experiencing fewer pregnancies. And children without mothers are less likely to survive (Hobcraft 1993).

The results of this study conducted by Hobcraft imply that net effect of maternal education after controlling other socioeconomic variables are very similar to its gross effect. Despite this, the impact of maternal education on infant health is found to be weak in sub-Saharan African countries by several studies Hobcraft has discussed. In an attempt to explain this result he has several suggestions. First, the greater independence of women in sub-Saharan Africa than in many Asian and Muslim societies may lead to weak relation. Second, interaction of traditional practices with maternal education may result in higher infant survival rates of mothers with no education than mothers with a few years of education. Third, weak health infrastructure in sub-Saharan Africa may prevent more educated mothers to take advantage of their knowledge; there may be a threshold of social development to benefit from education level. This is also mentioned by Davanzo and Habicht (1986) they state that effect of maternal education is stronger in more developed areas of Malaysia. He relates this to the necessity of minimal development needed to reduce infant mortality with maternal education. Finally the shortcoming of data may lead to this weak relationship between maternal education and infant mortality (Hobcraft 1993).

Education of mother is claimed to influence the survival chances of children also beyond the first year of life. Longer breastfeeding durations implemented by educated mother may lead to this long lasting effect (Hobcraft et al. 1984).

Pitt (1997) in his article examines the determinants of child health when fertility is not random, but selective, for 14 sub-Saharan DHS data sets. He claims that anything that has an impact of child health will also influence the fertility decision of parents. To clarify the effect of a schooling of mother on infant health; first, the probability of giving birth and then the effect of the education on mortality conditional on being born has to be estimated. Maternal education may influence infant health directly and indirectly through fertility, since education of mother is found to reduce fertility (Bhalotra and van Soest 2008). Maternal education may be biased, if change in education level causes changes in the proportion of the fertility of the children with different inherent healthiness. If rise in education decreases the fertility of the infants which have weaker inherent healthiness proportionately, ignoring the fertility selection may lead to overestimation of education effect. On the other hand, if the number healthier infants born reduce more than the other infants, the impact of maternal education will be underestimated. Results of the study indicate fertility selection arise underestimation of maternal education on infant health in 11 of the countries. However bias is small probably because of high fertility rates of sub-Saharan Africa (Pitt 1997).

### 2.1.7 Gender

Gender is an exogenous variable except the case of selective abortion. Including all the inputs in case of correlation between the inputs and gender of the baby will lead effects of gender to be only biological (Wolpin 1997). Correlation between inputs and gender will be the case if families have preferences for the survival of boys vs. girls, and differentiate the combination of inputs after being aware of the sex of the child.

Rosenzweig and Schultz have a different point of view. They study the determinants of sex-specific differentials of survival rates of rural India, other than biological effects. They suggest that the more economically productive is a gender the more resources are allocated to him/her and therefore the survival chance of that gender is higher. The female employment rate is used as a proxy for the potential contribution of girls, and a rise in the female employment rate decreases survival differential in favor of girls. An increase of 37% employment rate of females would eliminate the difference in the survival rates of girls and boys. Another interesting finding of the study is; increase in the wealth level is the other variable to improve survival of girls relative to boys (Rosenzweig and Schultz 1982).

### 2.1.8 Income

Income, or in general terms financial resources available to family, does not have an impact over infant mortality directly. Income may affect infants' health through the inputs available to the family. Therefore the only way it can influence infant health is through the omitted variables in the model or the correlation of income with the unobserved frailty (Wolpin 1997).

In an attempt to estimate the effects of health inputs on health hybrid health equations are formed, which include one or two health inputs and prices and income variables, because of the data restrictions on health inputs (Rosenzweig and Schultz 1983b). However, such a hybrid model described is hard to interpret. Change in use of some health inputs will have impact on other behavior through changing economic resources left for other inputs. Therefore the impact of health inputs will not reflect only their own effect; in addition to that they will include the effects of other behaviors that change (Wolpin 1997).

Income that is included in infant health equation does not always refer to income at household level. Some studies include income per capita in order to determine the facts causing differences in child survival. Factors measuring structural rather than individual phenomena, such as the extension of family support or income inequality, are usually not found to exercise any impact due to absence of variation in these factors in one country and at a point in time. To study the potential effects of income per capita time series analysis or cross-country studies, or combinations of these methods are used (Wennemo 1993).

Literature finds evidence of opposite movement of income per capita and infant mortality. Direct relationship between income per capita and infant survival is unreasonable. The impact of income on infant health may be through its impact on consumption of food, housing, sanitation, medical care and education (Flegg 1982). For example improvement in nutrition, which is declared to be one of the most significant explanatory variables to pull down the infant mortality, is associated with income growth (Bhalotra 2007).

It is found that not only the level of income but also income distribution effect infant mortality. Countries with more equal income distribution experience lower infant mortality rates that the countries with similar per capita income levels but unequal distribution. Infant mortality is mostly a concern among poor people because children and infants are very vulnerable to bad living conditions. Hence, increase in inequality cause the poor to be poorer, which results in increasing infant mortality (Wennemo 1993; Waldmann 1992; Flegg 1982)

Another striking argument made by Waldmann is that, increase in income share going to the richest 5 percent of the country increases infant mortality even after holding the income going to the poor constant. Potential explanations of this result are possibility of a larger fraction of babies are born to poor families in the countries with a high rich share, governmental policies that affect both the infant mortality and rich share, and distorted preferences and judgment of the poor by large rich share (Waldmann 1992).

### 2.1.9 Public Policy

Infant mortality is considered to be an indicator of deprivation that is used to measure the development levels of societies (Cramer 1987). Therefore it is of great importance to reduce infant mortality rate. This is the reason why child health is one of the central issues of public policy on health in developing countries, where infant mortality is a concern.

Increasing income per capita does not solely improve infant mortality, other factors and policies have to be taken into consideration. Examples of poor countries that has a better performance of infant mortality than middle income countries proves this (Fay et al. 2005). Wang in his study conducted for both national level and separately for rural and urban level determinants of infant and child mortality finds that, besides income per capita access to electricity, vaccination in the first year of infants' lives, public per capita health expenditure, and access to piped water and sanitation are significant at national level at decreasing child mortality. These results alter some when considered separately for rural and urban areas. Access to electricity becomes the most significant determinant in urban areas whereas in rural areas vaccination is the only significant factor (Wang 2003).

Public policy may directly and indirectly influence prices of health inputs by subsidizing them or by making access to them easier. Also public policy may provide information to increase effectiveness of health production. Finally, public policy may modify health environment (Schultz 1984).

The link between the Sudden Infant Death Syndrome (SIDS) and smoking is claimed to be robust by Markowitz. Postnatal smoking by mother and other household members besides prenatal smoking is tied to SIDS. Therefore any effort to decrease cigarette consumption is expected to decrease infant mortality. In the article it is found that strict regulations on smoking decreases SIDS. The most significant policy effecting infant mortality is taxation of cigarettes. Also restrictions on smoking in public areas lead a prominent decline in infant mortality (Markowitz 2008).

## 2.2 Literature on Infant Mortality in Turkey

IMR for Turkey in 2007 is 21 per 1000 live births. Due to this high rate of infant mortality Turkey cannot be classified demographically. There is contradiction between IMR and socio-economic indicators of the country. Doctors, demographers and sociologists found it difficult to give an explanation of much higher IMR in Turkey relative to the countries that have similar adult mortality rate with Turkey (Behar et al. 1999; Gursoy-Tezcan 1992). Low rates of fertility, high education level and medical coverage in Turkey conflicts with the rate of mortality among infants. Moreover, level of income per capita is far from being an explanation to the high IMR in Turkey. To give an example, Sri Lanka where GNP per capita is one third of Turkish GNP per capita experiences half of this rate (Aksit 1989).

Duration of breastfeeding is rather long in Turkey due to the cultural habits. In addition, the duration of breastfeeding lengthens as the education of mother decreases. Breastfeeding duration for female children is shorter than males but still longer than the durations in western societies. Consequently, the IMR puzzle of Turkey can neither be explained by breastfeeding (Tuncbilek et al. 1983).

Gursoy using data of Istanbul in an attempt to make an explanation to conflict studied the determinants of infant mortality in Turkey. According to the results of this study infant mortality risk is correlated with the education of the father, household composition, mother's attitude to abortion and the prevalence of smoking and drinking by household members. The higher the education of father and the more comfortable the women's attitude towards abortion is the lower will be the child mortality, whereas living in an extended family and smoking and drinking of household members other than mother is positively associated with infant mortality (Gursoy-Tezcan 1992). Another factor that is found to be correlated with infant mortality in Turkey is short inter-birth intervals (Gurel and Gurel 1995; Akadli and Tuncbilek 1987). Akadli and Tuncbilek considered preceding birth intervals shorter than 2 years as short and they stated that mortality risk of the children with short preceding birth interval is 2 times the mortality risk of the children with longer preceding birth interval. They also claimed that if all the inter-birth intervals were proper 27.8% of the infant mortality cases in Turkey would have been prevented (Akadli and Tuncbilek 1987).

Consanguineous marriage is very common especially in some regions in Turkey. It is argued that consanguineous marriage rate is 20-25%. Due to biological problems arising from human inbreeding, consanguineous marriage is thought as one of the major determinants of infant and child mortality in Turkey. Consanguineous couples are more likely to have high rates of fertility, low rates of sterility and come from socio-economically disadvantaged groups of the society (TUNÇBÍLEK and KOC 1994; Tuncbilek 2001). Therefore, unless the socio-economic factors related to infant mortality and consanguineous marriages are controlled the impact of consanguineous marriage on infant mortality will be biased.

Using the data of 29 centers in Turkey, Erdem stated that infant mortality rate can be reduced only by the co-operation of government, universities, obstetricians and neonatologists, improvement in prenatal, delivery and postnatal care and by preventing the premature births (Erdem 2003).

In a study Yüksel examined both macro level and micro level determinants of infant mortality in Turkey. The results of this study found improvement in health system to be the most important factor that has influence on infant's health at macro level where as total number of children born in a family, whether he index child is singleton and consanguinous marriages are found to be important factors at micro level (Yuksel September, 2008).

# CHAPTER 3

# DATA

## 3.1 Data

In an attempt to find out the determinants of infant mortality in Turkey data coming from Turkey Demographic and Health Survey (TDHS) conducted by Hacettepe University Institute of Population Studies in 2003-2004 is used in this study. Throughout this study infant mortality implies the mortality of the babies between the ages 0-11 months.

TDHS is a nationally representative survey. TDHS used in this study is conducted in 2003-2004. It is a survey of 11,517 women, from 10,836 households, between the ages 15 and 49. 8,075 of these women are married at least once. The data contains information about the fertility histories of mothers. Main reason of using TDHS is this property of the data. Moreover information about mother, mother's partner, child and housing characteristics are presented in the data. 7,360 women of 8,075 are mothers and they gave birth to 22,443 children. Of these 22,443 children 1,456 died before their first birthday. Multiple births are excluded from the data due to the higher mortality risk they contain, that may be due to factors that cannot be controlled in the model. Therefore, we end up with 21,985 children and 1,350 infant mortality cases. Infant mortality rate is calculated as the number of children dying before their first birthday per 1000 live births in the sample. Hence this calculation gives an infant mortality rate of 61.4 for singletons. This rate is 60.8 for female babies and 62 for male babies. Female babies are found better off than the male babies in the rough data.

In this study, sample is limited to 4,576 children who were born after 1998, five years before the survey. Even though this is only 21% of the entire sample, the number of children born after 1998 is large enough for our analysis. The main reason for this elimination is that; data for children born before that date is missing. Information about breastfeeding, antenatal check during pregnancy, place where the delivery took place, whether the delivery was assisted by any health sanitarian does not exist for those children. These variables are used commonly in the literature on determinants of infant mortality. Therefore, in order to find the correlation between these health inputs and infant mortality risk in Turkey the limitation of data is required.

As mentioned earlier in this chapter, children in the entire data are born in 1968-2004. However, there are fewer observations for children born earlier because data is restricted to women that are under the age 50. Moreover, these few children are not randomly selected from the sample. Maternal age at birth is very low for those children. To give an example, women who gave birth in 1968 and were older than 14 years old then, are not in the sample. Restricting data to last five years prevents this selection bias.

There are no data on characteristics of household when the child was born. Information of these variables is present only for the date when the survey was done. Wealth of the family, region and province they live in, source of the water used by the family are some of these variables. It is assumed that these variables do not change rapidly and stays stable for a while. Hence, these variables are thought as they were alike when the child was born. In addition to handling with missing data and selection bias problem using data of children who are born after 1998 also makes this assumption more reliable. For instance, place of residence of the family may have been different when the child was born. Mothers were asked for how many years they have lived in their current address; by using this information it is found out that only 77% of births occurred in the current place of residence for the entire sample, whereas this ratio is 94% for the children born after 1998. Therefore, the family level and community level characteristics at the date of the survey will be good proxies of these characteristics at the birth date of the children who are born after 1998.

Finally, during 37 years parameters of the specification might have changed. Assumption of constant parameters during this period might not be realistic.

Restricting the data to children born five years before the survey allows us to eliminate this assumption.

Of the 4,576 children born after 1998 128 infants died before reaching their first birthday and 147 children died before they reached the age 5. Hence, infant mortality rate for the children born after 1998 is 28 per 1000 live births and child mortality rate is 32.1 per 1000 live births. If only children born in last 5 years are taken into account infant mortality rate is lower than the infant mortality rate when the entire sample is used. This result is not unexpected, since IMR was claimed to decline as the birth year of the child increases. For this sub-sample IMR is 26.8 for female infants and 29.1 for male infants per 1000 live births. Female babies are still better off than male babies as in the entire sample.

## 3.2 Descriptive Statistics

The age composition of 128 infants that died before their first birthday is presented in Table 3-1 below. It can be seen that, nearly twenty percent of the infant mortality cases occurred just after the infant was born. 17.65% of male babies and 21.67% of female babies who died before their first birthday died suddenly after they were born, in the first day of their lives. Moreover, percentage of infant mortality cases occurring in the first month of infants' lives is more than 60%. This ratio is higher for boys than for female infants. Biomedical researchers refer to infant mortalities occurring during the first 28 days of the infant's life as neonatal mortality, and infant mortalities occurring during the $29^{th}$ day and $1^{st}$ year of infant's life as post neonatal mortality (Knodel and Kintner 1977). It can be seen from table that neonatal mortality rate is higher than post neonatal mortality rate in Turkey. The percentage of infant mortality cases decreases notably as the infants get older.

**Table 3-1 Distribution of infant mortality cases at each month (%)**

| Age of the infant (in months) | All | Male | Female |
|---|---|---|---|
| **00** | 19.530 | 17.650 | 21.670 |
| **0** | 41.410 | 47.060 | 35.000 |
| **1** | 8.590 | 8.820 | 8.330 |
| **2** | 3.130 | 1.470 | 5.000 |
| **3** | 10.160 | 7.350 | 13.330 |
| **4** | 2.340 | 4.410 | 0.000 |
| **5** | 3.910 | 1.470 | 6.670 |
| **6** | 3.130 | 5.880 | 0.000 |
| **7** | 2.340 | 0.000 | 5.000 |
| **8** | 2.340 | 1.470 | 3.330 |
| **9** | 0.780 | 1.470 | 0.000 |
| **10** | 1.560 | 1.470 | 1.670 |
| **11** | 0.780 | 1.470 | 0.000 |

For a better understanding of the distribution of infant mortality cases by the age of the infants, Figure 3-1 that shows the non parametric estimate of the survivor function is presented. Survivor function, which will be explained in detail in methodology chapter of this study, indicates the probability of survival of an infant until a specific time. Kaplan-Meier estimator of the survivor function estimates the survivor function from the data and it is calculated as the product of one minus the proportion of the infants died to the total infants at risk, that are alive. Figure 3-1 indicates that there is a sharp decline in the survival chance at the first month of the infants' lives, the probability of surviving until the first month is 0.985. The survival probability declines until the child is at age 1, but it decline is at a decreasing rate. The restricted sample used in this study implies that probability of surviving a year is 0.974 for an infant in Turkey.

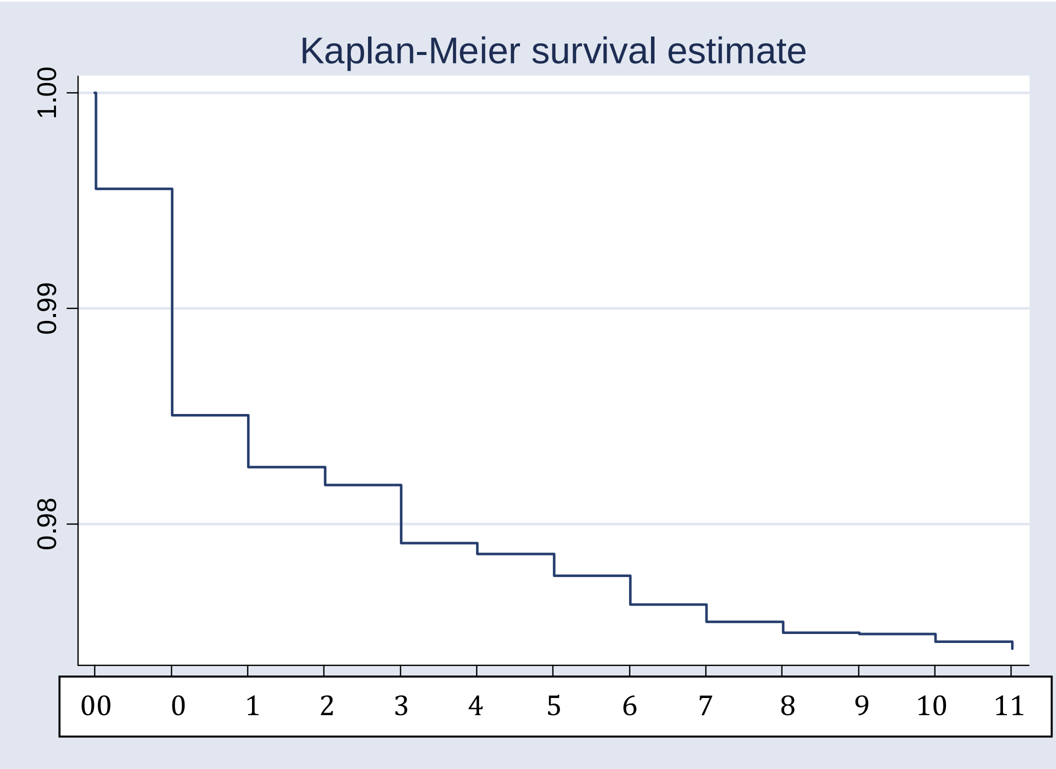


**Figure 3-1 Kaplan-Meier estimator of survivor function of the restricted data**

Figure 3-2 presents the non-parametric estimates of the hazard function – probability of dying at a specific age interval conditional on the survival of the infant up to that age. Probability of dying is a decreasing function of the survival time. The risk of dying is higher in the first months of the infants' lives.

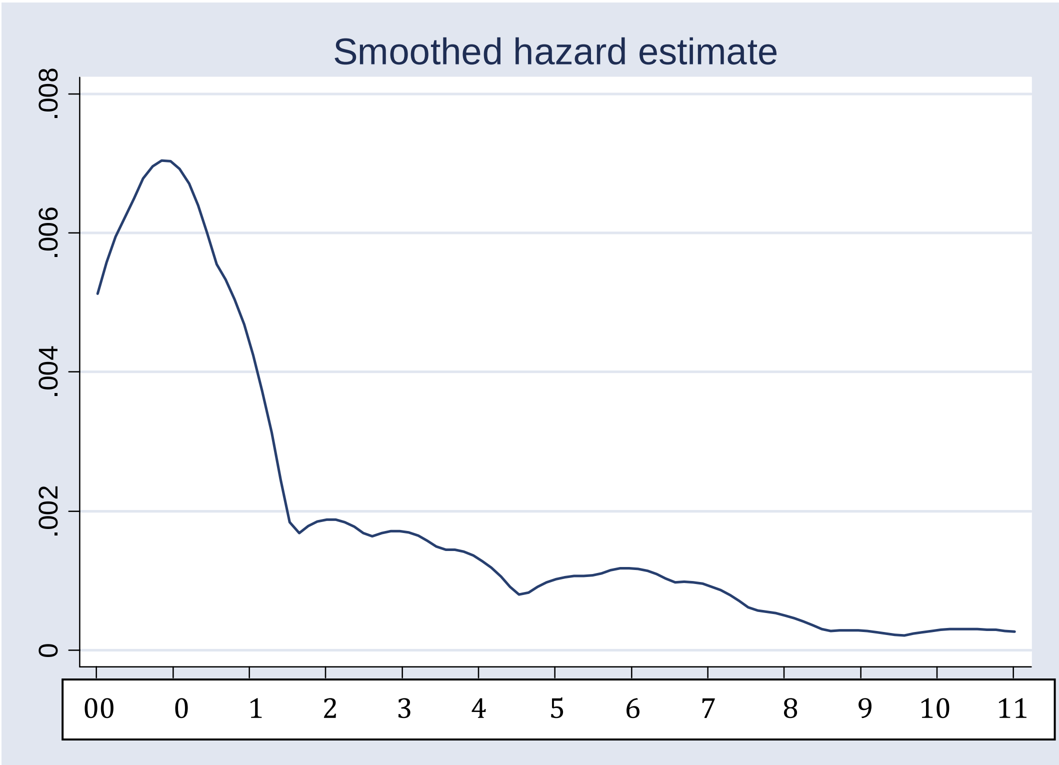


**Figure 3-2 Non-parametric estimate of hazard function of the restricted data**

In this analysis region is included as explanatory variable. Regional dummy variables refer to the regions where the family lives when the survey is done. Instead of twelve regions separated according to the degree of development, population density and geographical similarities of the provinces location of the province, five regions related to the location of the provinces are used. According to this regions are separated as central, west, east, south and north. Table 3-2 presents the infant mortality rates according to the regions and the gender of the child. From these 5 regions IMR is lowest for West Region, 18.9 per 1000 live births, and it is highest for East Region, 35.5 per 1000 live births. Infant mortality rate is worse for the eastern part of the Turkey, which are considered to be less developed and poorer than the other parts of the country. Infant mortality rate is higher for male babies than for female babies when the entire sample is taken into account. Except for the North and East regions advantage of female babies over the male babies is observed. For these regions IMR for female infant is remarkably higher than the IMR for female infants in West, South and Central Regions. These regions where infant mortality rate for female babies are high are also characterized by higher infant mortality rates than the other regions.

**Table 3-2 IMR (‰) according to the region**

| Region | All | Male | Female |
|---|---|---|---|
| West | 18.9 | 20.5 | 17.1 |
| South | 23.9 | 36.5 | 10.5 |
| Central | 20.4 | 26.8 | 13.2 |
| North | 29.6 | 25.4 | 34.3 |
| East | 35.5 | 32.4 | 38.7 |
| Total | 28 | 29.1 | 26.8 |

In Table 3-3 IMR specified for female and male infants is presented for urban and rural areas. For rural areas the IMR rate is higher than the IMR for urban areas, 35.5 and 24.3 respectively. Better outcomes are observed for female babies in rural areas of Turkey. However, in urban areas IMR for female and male babies are similar. The IMR differences within the groups are not high; the gender gap is not considerable.

**Table 3-3 IMR (‰) according to the type of place of residence**

| Type of Place of Residence | All | Male | Female |
|---|---|---|---|
| Urban | 24.3 | 24.3 | 24.3 |
| Rural | 35.5 | 39.3 | 31.7 |

As well as region and place of residence ethnicity is one other community level factor that is thought to be related to infant mortality. The mother tongue of the infant's mother is used to reflect the ethnicity of the infant. The most populated ethnic groups living in Turkey are the Turkish, the Kurdish and the Arabic. Therefore, these ethnic groups are included in this analysis. Figure 3-3 shows that better outcomes are observed for the ethnic Turkish babies than for the ethnic Kurdish and ethnic Arabian babies. The advantageous gender in terms of IMR differs among the different ethnicities. For the ethnic Turkish families' female babies are better off than males, on the contrary male babies do better than females for ethnic Kurdish and the ethnic Arabian families.

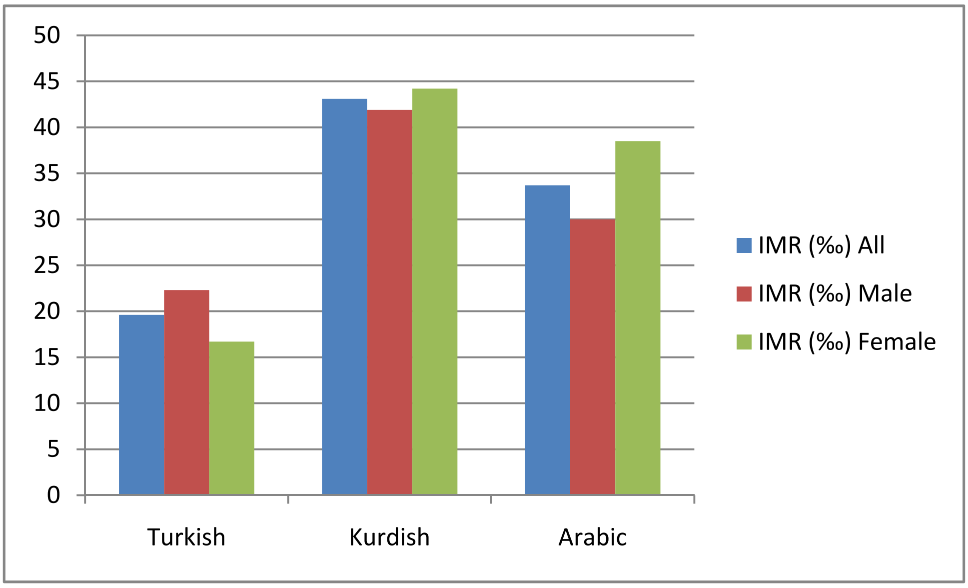


**Figure 3-3 IMR (‰) according to ethnicity**

Instead of these community level characteristics, there are also individual and household level characteristics that are thought to have influence on infant mortality. One of those factors is the gender of the baby. As mentioned above, infant mortality rate is lower among the female babies. Another factor that has an impact over infant mortality is the age of the mother when the infant is born. Maternal age at birth is calculated by subtracting mother's birth year from the child's birth year. This variable takes values between 13 and 47. Maternal age at birth is grouped into 6 intervals. The first group includes mothers that gave birth to the index child before they were 20 and the sixth group includes the mothers who gave birth after the age 39. Except these each of the remaining 4 intervals are of 5 years length. In this analysis for each age interval dummy variables are used. Infant mortality rate is the high for the mothers below the age 20 at 38.5 per 1000 live births. Beyond that age, a gradual decline in IMR takes place and IMR reaches to minimum for the mothers at ages between 25 and 29 at 17.8 per 1000 live births. IMR rises moderately for the women who gave birth after that age. Among these groups infant mortality rate is the highest for the mothers above the age 30 at 42.7 per 1000 live births. Difference between the infant mortality rates of males and females for each age group is observed. Female babies are better off than the male babies if maternal age at birth is below 20, above 39 or between 30 and 34. For other intervals of maternal age at birth male babies bear a lower risk. However gender gap is considerable only for the youngest and the oldest mothers.

**Table 3-4 IMR (‰) according to the maternal age at birth**

| Mother's age at birth | All | Male | Female |
|---|---|---|---|
| <20 | 38.5 | 51.3 | 24.2 |
| 20-24 | 30.7 | 29 | 32.7 |
| 25-29 | 17.8 | 16.1 | 19.6 |
| 30-34 | 26.9 | 32.6 | 21 |
| 35-39 | 38.6 | 33.7 | 43.2 |
| >39 | 42.7 | 56.6 | 31.3 |

Table 3-5 presents infant mortality rate by education level of mother and sex of the child. Dummy variables representing no education, primary school education, secondary school education and education level higher than secondary school are used in the analysis. These educational levels do not necessarily imply that the mother completed that levels, these categories also include school drop-out mothers. For instance, a woman whose highest educational level is reported as primary school may have attended the school only for 3 years. Increasing levels of education is associated with decreasing levels of infant mortality. This argument is valid when infant mortality rate is considered only for male babies or for female babies. The only exception of this is the higher level of infant mortality of male children of mothers with higher educational level than of male children of mothers with secondary education level. Another point to mention is that the male children of mothers with no education or secondary education are worse off than the male children of these mothers.

**Table 3-5 IMR (‰) according to the education level of the mother**

| Educational Level of Mother | All | Male | Female |
|---|---|---|---|
| **No education** | 46.5 | 56.5 | 36.7 |
| **Primary** | 24.5 | 22.2 | 26.8 |
| **Secondary** | 13 | 9.2 | 17.1 |
| **Higher** | 15.3 | 26.5 | 0 |

In this study wealth index is used in order to take into account the resources available to the household. Wealth index variable is presented by TDHS, and takes values between -2402770 and 2857500 for the restricted sample. For simplicity this variable is fitted to the interval 0-1. By normalizing this variable it will be easier to interpret the impact of explanatory variables interacted with wealth indices of the families. Another variable formed by TDHS classifies families according to their wealth indices into 5 groups from the poorest to the richest. IMR by this classified wealth index and sex of the child is displayed in Table 3-6. Children of families with higher wealth indices are observed to have lower infant mortality rates. The infant mortality rate for the poorest group of the sample is 41.2 whereas for the richest group this rate drops to 9.3 per 1000 live births. By considering infant mortality rates for female and male babies separately it can be argued that IMR gap among families with different wealth indices is higher for female children than male children. Female babies of the families in the poorest three groups of sample experience higher mortality rates than male babies. For the remaining groups female babies have lower mortality rates. This may be an evidence of different resource allocations among female and male babies. Scarce sources of poor families may be allocated to male babies due to the gender preferences of the parents.

**Table 3-6 IMR (‰) according to the wealth indices of the families**

| Wealth Index | All | Female | Male |
|---|---|---|---|
| **Poorest** | 41.2 | 45.2 | 37.4 |
| **Poorer** | 33.3 | 34.4 | 32.1 |
| **Middle** | 23.9 | 25.4 | 22.5 |
| **Richer** | 20.3 | 20 | 20.6 |
| **Richest** | 9.3 | 8.5 | 10.3 |

Water source in this analysis stands for hygienic conditions of the family. Water source is classified into 12 groups by TDHS. However, we have joined some of the similar groups in this study in order to simplify the results. We end up with 5 groups of households in terms of water source; first group consists of families using water piped into their house/garden or outside their house/garden, families in the second category uses water from public well and in the third group water used is from the well in house/garden, water sources of the families in the forth group are spring water, public fountain, river, stream, lake, dam, pond or rain water, fifth group includes families using bottled water or water from tanker truck, water station, and the households using all types of water sources left over. Infant mortality rates by water source and gender is given in Table 3-7. Infant mortality is the lowest for the families using water from the tanker, water station, bottled water or from the sources other than the sources mentioned above. The worst group in terms of infant mortality is the group consisting of the families using water from public well. IMR for this group of families is 108.4 per 1000 live births.

**Table 3-7 IMR (‰) according to the water source**

| Water source | All | Male | Female |
|---|---|---|---|
| **Piped water** | 26.3 | 24.2 | 28.6 |
| **Public well** | 108.4 | 175 | 46.5 |
| **Well in house/garden** | 23 | 23.3 | 22.7 |
| **Piped surface water/spring/public fountain/ river/ stream/ pond/ lake/ dam/rain water** | 32.7 | 32.5 | 32.9 |
| **Tanker/bottled/water station/other** | 14.9 | 24.5 | 3.6 |

The interval between the observed child and child preceded her/him is calculated simply by the birth dates of the children. For our restricted sample preceding birth interval takes values between 9 and 250 months. Preceding birth interval is taken as 250 months, largest value of the sample, for the first children who are not preceded by any other child. A dummy variable is created for the short preceding birth interval. 5% of the children have preceding birth interval shorter or equal to 13 months. Therefore cutoff point for short birth interval is determined as 13 months i.e. birth interval shorter than 14 months is considered as short. Figure 3-4 and Table 3-8 provide information about infant mortality rates by preceding birth interval and gender of the child. Table 3-8 shows the short preceding birth interval is accompanied by high levels of infant mortality. Babies with preceding birth interval shorter than 14 months are subject to higher risk of infant mortality than other babies; this claim is true for both female and male babies.

**Table 3-8 IMR (‰) according to the preceding birth interval**

| Preceding birth interval | All | Male | Female |
|---|---|---|---|
| **>13 or first child** | 25.7 | 28.4 | 22.8 |
| **<14** | 85.2 | 47.1 | 120.9 |

In Figure 3-4 infant mortality rates by wealth index and length of preceding birth interval are presented. A smooth decline in the infant mortality rate with increasing wealth index can be observed for the children with longer preceding birth intervals. Yet, infant mortality rate for the children with short preceding birth interval does not follow the similar path; decline in IMR for these children is very sharp. As mentioned in chapter of literature survey, one way through which short preceding birth interval can affect infant survival is argued to be through the scarce resources of the family. If this was the case infant mortality gap between short birth interval and long birth interval would have declined as wealth increased. Rough data seems to prove this argument. Infant mortality gap between the children with short and long preceding birth interval declines as the wealth of the family rises. This gap is high for the children of the poorest families and disappears for the children of the richest families.

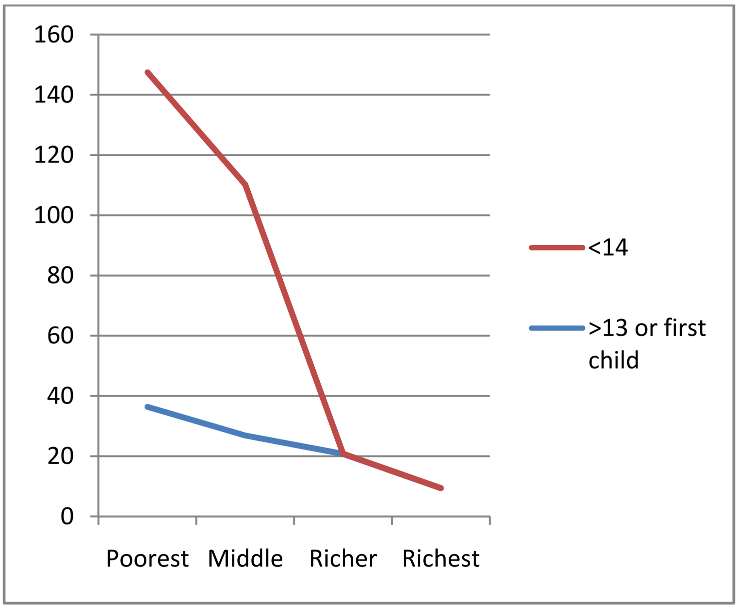


**Figure 3-4 IMR (‰) according to the preceding birth interval and wealth**

As mentioned in the literature survey there is a large literature that uses the interval between the index child and his/her succeeding sibling in addition to the preceding birth interval. In this study succeeding birth interval is not included to the model. To account for the impact of the birth of the succeeding sibling a dummy variable is included which takes value 1 when the conception of the succeeding sibling occurs. This is the same method used by Palloni and Tienda (Palloni and Tienda 1986).The interval between the birth of the index child and conception of the succeeding sibling is computed by subtracting 9 from the succeeding inter-birth interval of the index infant. In Table 3-9 descriptive statistics for succeeding conception at each age interval of infants' lives are given. According to this table 0.1 percent of the mothers became pregnant until the index child was 1 month old. This ratio rises as the infant ages. 10% of the infants among those who are between the ages 10-11 months were subject to succeeding conception. The percentage of female infants whose mothers experience succeeding conception is higher for all age intervals, except the first age interval. This means that women bearing a female child are more likely to become pregnant shortly after they gave birth than women bearing a male child.

**Table 3-9 Descriptive statistics for succeeding conception at each age interval**

| Age of the infant (in months) | All | Female | Male |
|---|---|---|---|
| **0** | 0.001 | 0.000 | 0.001 |
| | (0.026) | (0.021) | (0.029) |
| **1** | 0.003 | 0.003 | 0.002 |
| | (0.052) | (0.057) | (0.047) |
| **2** | 0.008 | 0.010 | 0.007 |
| | (0.092) | (0.101) | (0.082) |
| **3** | 0.016 | 0.020 | 0.013 |
| | (0.127) | (0.140) | (0.112) |
| **4** | 0.028 | 0.032 | 0.024 |
| | (0.165) | (0.176) | (0.153) |
| **5** | 0.037 | 0.045 | 0.029 |
| | (0.189) | (0.207) | (0.169) |
| **6** | 0.048 | 0.055 | 0.041 |
| | (0.214) | (0.228) | (0.198) |
| **7** | 0.059 | 0.068 | 0.051 |
| | (0.236) | (0.251) | (0.220) |
| **8** | 0.070 | 0.078 | 0.063 |
| | (0.256) | (0.268) | (0.243) |
| **9** | 0.079 | 0.086 | 0.072 |
| | (0.270) | (0.280) | (0.259) |
| **10** | 0.090 | 0.099 | 0.082 |
| | (0.287) | (0.299) | (0.274) |
| **11** | 0.101 | 0.111 | 0.090 |
| | (0.301) | (0.315) | (0.286) |

Note: Numbers in parenthesis are standard deviations.

Next, IMR variation with birth order of the child is examined. Table 3-10 presents infant mortality rates according to the birth order of the index child. A smooth pattern for infant mortality rate by the order of the infant is observed for the sample.

First children of the mothers experience lowest infant mortality rate at 20.1 per 1000 live births. As the birth order of the child increases infant mortality rate tends to rise until the fourth children of the mothers. IMR is highest for the children whose birth order is 4, at 46.7 per 1000 live births. Children with higher orders are more likely to come from large families. Therefore the impact of child order may also include the impact of family size on IMR.

**Table 3-10 IMR (‰) according to the order of the child**

| Child order | All | Male | Female |
|---|---|---|---|
| **1** | 20.1 | 22 | 17.8 |
| **2** | 23.1 | 24.1 | 22.1 |
| **3** | 24.8 | 24.9 | 24.7 |
| **4** | 46.7 | 39 | 54.5 |
| **>=5** | 42.4 | 47.8 | 36.8 |

The children in this restricted sample were born between the years 1999 and 2004. Birth years of the children are grouped into 6 intervals of 1 year length as 1999, 2000, 2001, 2002, 2003 and 2004. Birth year stands for variation of household and community level factors that are left out in the analysis. Socioeconomic development, improvements in health education, nutrition, sanitation, medical and health care, changes in policies implemented are believed to be related with infant mortality. Inclusion of birth year is supposed to account for those variables. Table 3-11 shows infant mortality rates by sex according to the birth year of the infant. It is observed that infant mortality rate for the children who were born recently is lower than for those who were born formerly. IMR is 24.7 per 1000 live births for the infants who were born before in 1999 whereas this rate drops to 18.2 per 1000 live births for the infants born in 2004. IMR does not follow a smooth pattern; it fluctuates from year to year. Therefore, the factors described above are not thought to be affective in improving IMR. Moreover six years is rather a short time period for these factors to change considerably and influence infant health. Improvements in all these factors through years might result in lower infant mortality rates for a loges time period. A possible factor leading to such a lower infant mortality rate for the children born 2004 is right censoring of these infants. The survey is conducted between December 2003 and May 2004. Therefore the children born in 2004 may not be older than 5 months old at the date of the survey. These children are right censored in the sense that the survival times of these children are ambiguous. The information about the date of death of these children is not presented in the data. Hence infant mortality rate for the children born in 2004 is lower because these children have not completed infancy at the date of the survey, the children who die in infancy among those infants cannot be known.

**Table 3-11 IMR (‰) according to the birth year of the child**

| Birth year | All | Male | Female |
|---|---|---|---|
| **1999** | 24.7 | 32.1 | 17.6 |
| **2000** | 32 | 29.8 | 34.4 |
| **2001** | 27.8 | 29 | 26.5 |
| **2002** | 31.2 | 28.9 | 33.7 |
| **2003** | 25.3 | 24.7 | 25.9 |
| **2004** | 18.2 | 34.5 | 0 |

Table 3-12 presents infant mortality rates by sex of the child and by prenatal care that is thought to be associated with infant mortality. Infant mortality rate is given by the duration of prenatal care received by the mother of the index child. Survey included information about the month of the pregnancy the mother started receiving prenatal care. Duration of prenatal care is calculated by subtracting the month of initiation of prenatal care from 9. The value of duration of prenatal care is bounded above by 9, which is taken as the duration of the pregnancy. IMR is highest for the children that have not received any prenatal care. For these children infant mortality rate is 50.6 per 1000 live births. Infant mortality rate declines as the duration of prenatal care increases until the fifth month of prenatal care. Infant mortality rate increases when duration of prenatal care exceeds five months. This may be due to the negative self selection described in the literature. Mother who observed sign of weak child or experienced problems during the pregnancy might have chose to start prenatal care earlier, in the first months of the conception of the index child. IMR is 14.4 per 1000 live births for the children whose mothers started receiving prenatal care at the beginning of the pregnancy.

**Table 3-12 IMR (‰) according to the duration of prenatal care**

| Duration of prenatal care (in months) | All | Male | Female |
|---|---|---|---|
| **0** | 50.6 | 51.4 | 49.7 |
| **1** | 26.3 | 45.5 | 0 |
| **2** | 35.3 | 54.1 | 20.8 |
| **3** | 15.9 | 15.2 | 16.7 |
| **4** | 14.6 | 9.1 | 20.8 |
| **5** | 9.4 | 9.7 | 9.2 |
| **6** | 22.8 | 20.3 | 25.3 |
| **7** | 25.1 | 28.9 | 20.7 |
| **8** | 13.1 | 14.2 | 11.9 |
| **9** | 14.4 | 10 | 19.2 |

Table 3-13 present infant mortality rates by the sex of the infants and by the place of delivery. This table implies that children who were delivered at home are more likely to die than the children that are delivered in a hospital, health center or in a clinic. IMR for the children delivered at home is 46.7 per 1000 live births. The most favorable group consists of babies that were delivered in a private hospital, clinic or in a private doctor's office. Having observed that the higher wealth level is associated with lower infant mortality cases, low infant mortality rate of babies born in a private place may be due to the correlation between the wealth of the family and the place of delivery of the infant. This means if wealthier families are more likely to deliver their children in a private hospital, clinic or in a private doctor's office, lower IMR for these children may be due to higher wealth indices of their families not solely due to the place of delivery.

**Table 3-13 IMR (‰) according to the place of delivery**

| Place of delivery | All | Male | Female |
|---|---|---|---|
| **Home** | 46.7 | 46.4 | 47 |
| **Government hospital** | 22.7 | 22.8 | 22.7 |
| **Health centre** | 30.1 | 30.6 | 29.6 |
| **MCHFP centre/ other public** | 7 | 3.5 | 10.5 |
| **Private hospital/clinic/doctor** | 5.9 | 7.3 | 4.3 |
| **Other** | 272.7 | 333.3 | 0 |

Finally, duration of breastfeeding is included as explanatory variable in this analysis. Information about the duration of breastfeeding of the infants is available for the children born after the year 1998. Due to the truncation of breastfeeding that is described in the literature survey chapter of this study duration of breastfeeding is not included as the months the infant is breastfed. Instead, a dummy variable is created that takes value 1 if the child is breastfed during the considered age interval of the infant's life and it takes value 0 if the child is not breastfed that period. Moreover, this variable is taken as 0 for all the children at the first day of their lives. This method is similar to the method used to account for the birth of the next child and the method used to observe the impact of breastfeeding on infant mortality by Palloni and Tienda (Palloni and Tienda 1986).

In Table 3-14 descriptive statistics for breastfeeding at ach age interval of children are presented. This table implies that at their first month of lives 90% of the infants were breastfed. This ratio declines as the infant ages. Among the infants who are at twelfth month of their lives 44% were breastfed. In the rough data we cannot find the evidence of male preference of the mothers. Since, the percentage of the female infants breastfed is higher than the percentage of males infants breastfed almost at all age intervals of the infants' lives.

**Table 3-14 Descriptive statistics for breastfeeding at each age interval**

| Age of the infant (in months) | All | Female | Male |
|---|---|---|---|
| **0** | 0.902 | 0.910 | 0.894 |
| | (0.297) | (0.286) | (0.308) |
| **1** | 0.859 | 0.863 | 0.856 |
| | (0.348) | (0.344) | (0.351) |
| **2** | 0.805 | 0.805 | 0.806 |
| | (0.396) | (0.396) | (0.396) |
| **3** | 0.767 | 0.770 | 0.765 |
| | (0.422) | (0.421) | (0.424) |
| **4** | 0.733 | 0.740 | 0.726 |
| | (0.443) | (0.439) | (0.446) |
| **5** | 0.661 | 0.675 | 0.648 |
| | (0.473) | (0.469) | (0.478) |
| **6** | 0.636 | 0.642 | 0.630 |
| | (0.481) | (0.479) | (0.483) |
| **7** | 0.614 | 0.613 | 0.615 |
| | (0.487) | (0.487) | (0.487) |
| **8** | 0.585 | 0.586 | 0.583 |
| | (0.493) | (0.493) | (0.493) |
| **9** | 0.564 | 0.568 | 0.561 |
| | (0.496) | (0.495) | (0.496) |
| **10** | 0.549 | 0.548 | 0.550 |
| | (0.498) | (0.498) | (0.498) |
| **11** | 0.444 | 0.434 | 0.454 |
| | (0.497) | (0.496) | (0.498) |

Note: Numbers in parenthesis are standard deviations.

# CHAPTER 4

# METHODOLOGY

## 4.1 Survival Analysis

In this study survival analysis is conducted to find out the determinants of infant mortality in Turkey. Infant mortality is referred to the mortality of the children at ages 0-11 months. Survival analysis is thought to be more efficient than linear regression and binomial regression for this analysis since it is formed to model time to even data, in this case event is considered as death of the infant. Survival analysis predicts the risk of dying at a certain time for an infant. Dependent variable in this model is the age of the infant in months. Child enters the risk set when they are born and failure occurs by the death of the child. By using survival analysis the probability that a child that has lived t months will die until t+1 months is modeled as a function of age of the infant and controlling for the explanatory variables that are expected to determine infant mortality.

At that point it is important to distinguish weather duration of life of the infant is continuous or discrete. Survival time of an infant –length of time infant is alive – is intrinsically continuous. However, information of exact length of infants' lives is not presented in the data, survival times of the infants are reported in months. This kind of data known as grouped data prevents the analysis to use continuous time specifications. Discrete time specification for survival analysis is used in this study. Waiting time will be grouped into intervals. Except the first one, intervals will be of 1 month length. For the first year of the infants' lives create 13 intervals. The first interval will be related to the first day of the infants' lives. Second interval starts at the second day of the life and lasts until the infant is 2 months old. Thirteenth interval starts at the beginning of the twelfth month and ends at the $365^{th}$ day of the infants' lives.

The basic concepts of survival analysis are hazard rate and survivor function. At discrete time analysis, hazard rate is defined as the probability of dying at a specific age interval conditional on the survival of the infant up to that age. It is defined as;

$$\lambda_j = \Pr(T = t_j \mid T \geq t_j) \tag{4-1}$$

where t denotes some specific time, and T denotes the age of the infant at death.

Survivor function indicates the probability of survival of an infant until a specific time, t. Survivor function is defined as;

$$\boldsymbol{S(t) = Pr(T \geq t) = 1 - F(t)} \tag{4-2}$$

where F(t) is the cumulative distribution function. Survivor function is related to the hazard function in a way that is given by the equation (Cameron and Trivedi 2005);

$$\boldsymbol{S(t) = \prod_{j \mid t_j \leq t}(1 - \lambda_j)} \tag{4-3}$$

To give an example, S(2) indicates the probability that a child will survive 2 months and it is equal to the product of the probability of surviving in the first month and the probability of surviving in the second month conditional on surviving in the first month. Survivor function is a non-increasing function since cumulative distribution function is monotonically increasing function.

Data used in this study comes from TDHS, it includes birth histories of women between the ages 15 and 49. Some of the children of these women are alive at the time of the survey but they are still at risk since they have not reached age 1 at the date of the survey. The only information about the survival time of these children is that they lived more than their age at the survey date. These children are right censored. Survival analysis can handle this feature of the data since it is explicitly designed to deal with censoring in a correct way. Survival analysis uses maximum likelihood estimation method rather than ordinary least squares in order to deal with right censoring. Likelihood contribution of a censored spell and completed spell is taken into consideration separately and likelihood function for the whole sample is calculated using those contributions. Likelihood contribution of a censored spell will be its survival probability and likelihood contribution of a completed spell will be its density function. Therefore if we take $c_i$ as a censoring indicator taking value

1 if the observation is complete and 0 if the observation is censored where subscript i stands for the index of the infant. The likelihood function for the whole sample will be;

$$\boldsymbol{\mathcal{L}} = \prod_{i=1}^{n}[\mathbf{Pr}\ (\boldsymbol{T_i} = \boldsymbol{j})]^{c_i}[\mathbf{Pr}\ (\boldsymbol{T_i} > \boldsymbol{j})]^{\mathbf{1}-c_i} \tag{4-4}$$

$$= \prod_{i=1}^{n}[\left(\frac{\lambda_{ij}}{1-\lambda_{ij}}\right)^{c_i} \prod_{k=1}^{j}(\mathbf{1} - \boldsymbol{\lambda_{ik}})\ ] \tag{4-5}$$

Taking the natural logarithm of the both sides of the equation we obtain the log-likelihood function that is to be maximized as;

$$\boldsymbol{log\mathcal{L}} = \sum_{i=1}^{n} \boldsymbol{c_i log}\left(\frac{\lambda_{ij}}{1-\lambda_{ij}}\right) + \sum_{i=1}^{n}\sum_{k=1}^{j} \mathbf{log}\ (\mathbf{1} - \boldsymbol{\lambda_{ik}}) \tag{4-6}$$

The rationale behind this equation is that; we know the duration of the infants who died before they are at age 1. However the exact duration of the censored infant's life is not known, it is only known that these infants were alive when the survey was done, they certainly lived up that age but there is no more information about them.

Most of the studies suffered from truncation problem when using breastfeeding as an explanatory variable. This problem comes across when the death of the infant terminates breastfeeding, which would be longer if the child were alive. Truncation of breastfeeding results in underestimation of this variable if not taken into account. Survival analysis can handle these two features of the data described; right censored observations and truncation of the explanatory variables caused by the death of the infant.

The truncation of breastfeeding is dealt in a same manner as Palloni and Tienda did (Palloni and Tienda 1986). First, the survival time of the infant are split for each infant into sub-periods of one month. Data is reorganized so that each infant has records for each sub-period. Each infant who died before reaching age 1 or who are still alive but are smaller than 1 has as many records as the length of the infant's life, the others who were alive when they were 1 year old has 13 records, 1 for the beginning of the life and 12 for each month until the age 1. Variables that are constant through the lifetime of the infant take the same value for all the sub-periods. These variables are referred as time invariant variables and one example may be the mother's age when she gave birth to the child. A binary variable, $y_{ik}$, is generated; this variable takes value 1 for the month that infant dies and 0 otherwise. Therefore for the infants that died before reaching age 1 this binary variable is zero for all the sub-periods but the last and for the infants that did not die or are censored the binary variable is 0 for all the sub-periods. After rearranging data log likelihood function to be maximized becomes;

$$\boldsymbol{log\mathcal{L}} = \sum_{i=1}^{n}\sum_{k=1}^{j} y_{ik} log\left(\frac{\lambda_{ij}}{1-\lambda_{ij}}\right) + \sum_{i=1}^{n}\sum_{k=1}^{j} \log(1-\lambda_{ik}) \quad (4\text{-}7)$$

A binary model with dependent variable $y_{ik}$ would have the same the likelihood function. This enables us using one of the binary models like logit or probit for the estimation of the model.

Also breastfeeding is taken as a dummy variable taking value 1 if the infant is breastfed during that sub-period and 0 if the infant is not breastfed. Breastfeeding variable indicates whether the breastfeeding was still continuing at the beginning of the related month or it has terminated before entering that sub-period. Breastfeeding is taken as a time-varying covariate taking different values through time. The value of breast feeding changes because the infant grows older. Therefore it is also important to allow the model to include explanatory variables whose values changes through time. Besides censoring problem survival analysis can handle time varying covariates. Breastfeeding for an infant will be fixed within each month but can be different through the intervals. Then survival probability of the infant in each sub-period, in this case in each month, is estimated as a function of breastfeeding. This allows us comparing infants only that lived up to certain age. The truncation problem is solved by treating the survivors and non-survivors in a similar way.

A similar problem to truncation of breastfeeding arises when interval between the index child and his/her succeeding sibling is included in the model. Short succeeding birth interval may be the result of infant mortality, not the cause of it, because of replacement effect. Replacement effect takes place parents decide to have another child after the death of the index child. In order to eliminate the cases where death of the infant precedes the birth of the following sibling the interval between the index child and his/her succeeding sibling is included in the model with a method similar to breastfeeding. For the purpose of finding out the impact of the conception of the succeeding sibling a time varying dummy variable is created. This dummy variable takes value 1 if mother become pregnant before the considered age interval (x, x+n) and it takes value 0 otherwise. Using this method eliminates the reverse causality problem because if the death of the index child takes place before than the conception of his/her sibling this variable takes value 0 for all sub-periods of infant's life.

## 4.2 Logistic Regression

As mentioned at the previous section due to data restrictions continuous time models cannot be used in this analysis. Survival times of the infants are reported in months therefore it will be appropriate to use one of the discrete time models of the survival analysis. Logistic model which is developed for discrete survival times is conducted in this analysis.

Logistic regression assumes that the probability of dying in period j, given survival up to the period (j-1) is in the form;

$$\boldsymbol{\lambda(j, X)} = \frac{\mathbf{1}}{\mathbf{1+exp}\,(-\boldsymbol{\alpha_j} - \boldsymbol{\beta' X})} \tag{4-8}$$

Alternatively this expression can be written as;

$$\boldsymbol{logit}\,[\boldsymbol{\lambda(j, X)}] = \boldsymbol{log}\left[\frac{\boldsymbol{\lambda(j,X)}}{\mathbf{1}-\boldsymbol{\lambda(j,X)}}\right] = \boldsymbol{\alpha_j} + \boldsymbol{\beta}'\mathbf{X} \tag{4-9}$$

where X is a set of characteristics for the infants. This is the hazard function of the logistic model as a function of time and characteristics of the infant. The function implies that probability of dying in a period depends on the characteristics and the age of the infant that have survived up to this time.

In the function above the term $\lambda(j, X)/1 - \lambda(j, X)$ measures the risk of dying at period j relative to surviving at this period given that the infant survived in period (j-1), and it is called odds ratio. Interpreting the coefficients as the marginal effects of the covariates on the odds ratio is quite common. In this study our model will be similar to that discussed above and the interpretation of the slope term will be in this manner. With the help of calculus we can calculate the response of the odds ratio to a given change in covariates. In order to simplify the calculations we name odds ratio as f(X, j). Taking the derivative of the log of the odds ratio with respect to the i[th] covariate ($X_i$) will give us;

$$\frac{\delta \log(f(X,j))}{\delta X_i} = \frac{\delta \log(f(X,j))}{\delta f(X,j)} \times \frac{\delta f(X,j)}{\delta X_i} = \frac{\delta f(X,j)/f(X,j)}{\delta X_i} = \boldsymbol{\beta_i} \qquad (4\text{-}10)$$

Now interpretation of the slope coefficient $\beta_i$ which is the coefficient of relevant X regressor in the model is straight forward. A unit increase in the regressor $X_i$ will results in an increase in odds ratio by a multiple of $\beta_i$. For instance if $\beta_i$ is 1 as a result of a unit increase in the variable $X_i$ hazard of dying in period j relative to the chance of surviving in that period will be doubled.

## 4.3 The Specification

The data includes all the children of the women. Most of the women in the sample have more than one child. Therefore the data contains information on siblings. It is likely that children from the same family share a common risk of mortality. Sharing the same socioeconomic environment as well as genetic factors and behavioral factors may result in correlation of survival probabilities (Dasgupta 1990; Guo 1993; Guo and Rodriguez 1992). Some mothers tend to have problems during pregnancy and have premature babies; all children of these mothers will share the same biological risk. Usually siblings grow in a similar home environment; characteristics of this environment may have influence on the siblings' health living there. Also behaviors of parents during raising an infant is related to the health of the siblings (Curtis et al. 1993). Due to this correlation observations will not be independent. Therefore we have to treat risk of mortality of an infant independent between the different families but dependent between the infants of the same family.

Estimating the infant mortality under the assumption of independent observations leads the standard errors of the estimated parameters to be underestimated (Curtis et al. 1993; Guo 1993). Guo states that the child whose sibling has dead is more likely to die than an average child. The data will be more volatile than the estimated model as a result of this statement. The number of families experiencing more than one child mortality and also the number of families of not experiencing child mortality at all will be above the average level estimated. Taking the observation of living sibling as independent of the dead child will be misleading because contribution of this child to the model is less than the other child. Information contained by this observation is incomplete since the common characteristics with the dead sibling have already been included. Smaller standard errors will result in larger t values of the parameters, and we would be incapable of concluding the insignificance of a variable.

In this study the logistic model, a discrete time specification of survival analysis is used in order to find out the determinants of infant mortality in Turkey. Similar to the analyze by Rosenzweig and Schultz (Rosenzweig and Schultz 1983a) the hazard rate of the child i of mother j at time t is assumed to be as;

$$\boldsymbol{\lambda_{ijt} = \lambda\,(X_{ij,}\, X_{ij}(t))} \qquad (4\text{-}11)$$

In the equation $X_{ij}$ refers to the time invariant covariates included in the specification related to the $i^{th}$ child of the $j^{th}$ family, and $X_{ij}(t)$ refers to the time varying covariates of the same child. Child specific component of unobserved heterogeneity is not included in this analysis. It is assumed that there is no correlation between the behaviors of the parents and child specific component of frailty. In parallel with logistic regression and family specific frailty model estimated will be like;

$$\boldsymbol{log\left[\frac{\lambda_{ijt}}{1-\lambda_{ijt}}\right] = \alpha_0 + \sum_{i=1}^{k_1} \beta_i X_{ij} + \sum_{i=k_1}^{k_2} \beta_i X_{ij}(t) + u_{ij}} \qquad (4\text{-}12)$$

This equation can be interpreted as the log of odds ratio consists of a set of characteristics related to the infant.

Model is estimated by clustering the data. Clustering the data controls the exogenous family specific endowment which is common for all the children of the same mother but differ across families. This parameter accounts for the family specific component of unobserved heterogeneity. Estimation by clustering the data according to the mothers of the infants does not change the estimates of the parameters; it only adjusts the standard errors of the parameters to allow for the correlation between the siblings.

Time varying covariates used in this study are duration of breastfeeding of the child and interval between the index child and occurrence of conception of his/her succeeding sibling. As explained before the method employed to deal with the problem of reverse selection for breastfeeding and succeeding birth interval is to create dummy variables that can take different values for each age interval. In case of breastfeeding the variable takes value 1 until the infant is weaned, then it becomes 0 for the same child. Variable related to the birth of the succeeding birth interval takes value 1 until the mother of the index infant becomes pregnant, and then it becomes 0.

Place of delivery, prenatal care received by mother, preceding birth interval, wealth index, maternal age at birth, education level of the mother, gender of the child, source of water, region and type of place of residence where the family lives, ethnicity of the child, birth order and birth year of the infant are time invariant variables used in this analysis. These variables take a constant value at every age interval.

In this study prenatal care is taken both as a binary variable indicating whether the infant received any prenatal care and as the duration of prenatal care. Duration of prenatal care is calculated by subtracting the initial month of pregnancy when the mother received prenatal care from 9. Gestation length for all the children is assumed to be 9 months. For the premature births this measure will overestimate the true value of prenatal care received. Hence, the effect of prenatal care will be underestimated if premature born infants are more likely to die. Underestimation of the effect will take place because longer durations of prenatal care will be associated with higher infant mortalities. In the literature prenatal care is taken as one of the most important determinants of infant mortality. Therefore in spite of the problems it possesses, omitting prenatal care from the model is not taken into consideration in this study.

Wealth index presented in the data is used as a proxy indicator of economic status of the family. It is believed that wealth index will reflect financial resources available to the family better that the income earned by the households. This index measures families' assets and utility services. Wealth index in the data was constructed from the data on assets, services and amenities of the family. These assets, services and amenities used to calculate wealth index includes items owned by the household like refrigerator, radio, car etc., source of drinking water and type of sanitation facilities (Rutstein et al. 2004).

# CHAPTER 5

# RESULTS

In this chapter the results of our analysis are presented. Infants that are born before 1999 are excluded and the model is estimated using this restricted sample. As discussed before this restriction on the data serves for observing the impacts of variables that are missing for the children born before 1999, such as breastfeeding, prenatal care and place of delivery.

Two models are formed in this study. In the first model, regional and household variables as well as child specific variables that are thought to be exogenous are included. The first model also includes interaction of breastfeeding with wealth index of the family in order to examine the differentiated impact of this variable for families with different levels of wealth indices. In the second model, variables that might depend on the parents' choices are included in addition to the variables used in the first specification. In the second model interaction of inter-birth intervals with wealth index in addition to interaction of prenatal care, sex of the child and education level of the mother with the age of the infant are included

The coefficients, odds ratios and robust standard errors of covariates are given for first model estimated in Table 5-1. First column presents the coefficients of the first model estimated whereas the second column presents the odds ratios of the model. Explanatory variables included in the model are: interaction of breastfeeding with wealth index and age of the infant, wealth index, mother's age when she gave birth to the index child, interaction of mother's education level and gender with age of the infant, water source, region where the household lives, whether the family lives in rural or urban area, ethnicity, birth order, birth year, and the age of the infant in months. The interaction of breastfeeding with wealth index is included so that the differentiated impacts of breastfeeding for households of different economic statuses can be observed. We can expect the correlation between infant mortality risk and breastfeeding to decrease for the richer families because of the availability of substitutes of breastfeeding for these families. Furthermore, in order to examine the effects of breastfeeding, gender and education level of mother at different stages of the infants' lives these variables are interacted with selected age intervals. This enables us to differentiate the impact of these variables on recently born infants from the impact of them on infants at age 0-11 months.

**Table 5-1 Logit estimate results for infant mortality for the first specification**

| | Coefficient | Odds Ratio |
|---|---|---|
| **Breastfeeding** | | |
| **Breastfeed * age(00 + 0 + 1)** | -5.412*** | 0.004*** |
| | [1.429] | [0.006] |
| **Breastfeed * age(2 - 11)** | -2.939** | 0.053** |
| | [1.192] | [0.063] |
| **Breastfeed * age(00 + 0 + 1) * wealth** | 2.851 | 17.308 |
| | [3.351] | [57.994] |
| **Breastfeed * age(2 - 11) * wealth** | -0.381 | 0.683 |
| | [2.679] | [1.830] |
| **Wealth index (Base category: Poorest)** | | |
| **Wealth index : Poorer** | -0.171 | 0.842 |
| | [0.285] | [0.240] |
| **Wealth index : Middle** | -0.253 | 0.777 |
| | [0.329] | [0.256] |
| **Wealth index : Richer** | -0.516 | 0.597 |
| | [0.358] | [0.214] |
| **Wealth index : Richest** | -1.094* | 0.335* |
| | [0.628] | [0.210] |
| **Maternal age at child's birth (Base category : 25-29)** | | |
| **Mother's age< 20** | 1.626*** | 5.083*** |
| | [0.393] | [1.995] |
| **Mother's age : 20-24** | 0.966*** | 2.627*** |
| | [0.300] | [0.788] |
| **Mother's age : 30-34** | 0.538 | 1.713 |
| | [0.350] | [0.599] |
| **Mother's age : 35-39** | 0.747* | 2.110* |
| | [0.449] | [0.948] |
| **Mother's age>39** | 0.354 | 1.424 |
| | [0.549] | [0.781] |
| **Maternal education level (Base category: No education)** | | |
| **Primary * age(00)** | 0.618 | 1.856 |
| | [0.480] | [0.891] |
| **Primary * age(0-11)** | -0.243 | 0.784 |
| | [0.290] | [0.227] |
| **Secondary * age(00)** | 0.213 | 1.237 |
| | [0.902] | [1.116] |
| **Secondary* age(0-11)** | -0.364 | 0.695 |
| | [0.497] | [0.345] |
| **Higher* age(00)** | 1.850 | 6.362 |
| | [1.246] | [7.926] |
| **Higher* age(0-11)** | 0.315 | 1.371 |
| | [0.848] | [1.163] |

**Table 5-1 (continued)**

| | | |
|---|---|---|
| **Sex of the index child (Base category: Male)** | | |
| **Female* age(00)** | -0.025 | 0.975 |
| | [0.457] | [0.446] |
| **Female* age(0-11)** | -0.243 | 0.784 |
| | [0.234] | [0.183] |
| **Water Source (Base category: piped into house/garden or outside house/garden)** | | |
| **Public well** | 1.138** | 3.120** |
| | [0.507] | [1.583] |
| **Well in house/garden** | -0.624 | 0.536 |
| | [0.624] | [0.335] |
| **Piped surface water/spring/public fountain/ river/ stream/ pond/ lake/ dam** | 0.233 | 1.263 |
| | [0.317] | [0.401] |
| **Tanker/bottled/water station/other** | 0.664 | 1.942 |
| | [0.460] | [0.893] |
| **Region (Base category: West)** | | |
| **Region: Central** | 0.009 | 1.009 |
| | [0.398] | [0.402] |
| **Region: East** | 0.439 | 1.550 |
| | [0.403] | [0.624] |
| **Region: South** | 0.363 | 1.438 |
| | [0.426] | [0.613] |
| **Region: North** | 0.606 | 1.833 |
| | [0.493] | [0.903] |
| **Type of place of residence** | | |
| **Rural** | -0.056 | 0.945 |
| | [0.351] | [0.332] |
| **Large city** | 0.129 | 1.138 |
| | [0.423] | [0.481] |
| **Small city** | -0.200 | 0.819 |
| | [0.355] | [0.291] |
| **Ethnicity (Base category: Turkish)** | | |
| **Kurdish** | 0.557* | 1.746* |
| | [0.307] | [0.537] |
| **Arabic** | -0.002 | 0.998 |
| | [0.573] | [0.572] |
| **Child order (Base category: Birth order = 1)** | | |
| **2** | 0.521* | 1.684* |
| | [0.303] | [0.510] |
| **3** | 0.523 | 1.688 |
| | [0.361] | [0.610] |
| **4** | 1.279*** | 3.595*** |
| | [0.415] | [1.491] |
| **> 5** | 0.835** | 2.305** |
| | [0.411] | [0.947] |

**Table 5-1 (continued)**

| | | |
|---|---|---|
| **Age interval in months (Base category: 00)** | | |
| **0** | 4.052*** | 57.522*** |
| | [0.496] | [28.547] |
| **1** | 2.071*** | 7.936*** |
| | [0.632] | [5.012] |
| **2** | 0.541 | 1.719 |
| | [0.732] | [1.257] |
| **3** | 1.545*** | 4.686*** |
| | [0.557] | [2.611] |
| **4** | -0.293 | 0.746 |
| | [0.769] | [0.574] |
| **5** | 0.190 | 1.209 |
| | [0.676] | [0.817] |
| **6** | 0.436 | 1.546 |
| | [0.715] | [1.105] |
| **7** | -0.099 | 0.906 |
| | [0.728] | [0.660] |
| **8** | -0.675 | 0.509 |
| | [0.773] | [0.393] |
| **9** | -2.600** | 0.074** |
| | [1.106] | [0.082] |
| **(10 + 11)** | -1.276* | 0.279* |
| | [0.763] | [0.213] |
| **Birth year (Base category: Birth year = 1999)** | | |
| **Birth year : 2000** | 0.048 | 1.049 |
| | [0.347] | [0.364] |
| **Birth year : 2001** | -0.028 | 0.972 |
| | [0.370] | [0.360] |
| **Birth year : 2002** | -0.126 | 0.882 |
| | [0.358] | [0.316] |
| **Birth year : 2003** | -0.253 | 0.777 |
| | [0.356] | [0.276] |
| **Birth year : 2004** | -1.924** | 0.146** |
| | [0.819] | [0.120] |
| **Pseudo-$R^2$** | 0.2883 | 0.2883 |

Note: The number of observations is 52,892. Robust and clustered at household level standard errors are in brackets beneath regression coefficient and odds ratio. The level of statistical significance of each estimate is indicated by ***, ** and * for the one, five and ten percent levels, respectively.

In Table 5-2 the coefficients, odds ratios and robust standard errors of covariates are given for second model estimated. First column presents the coefficients of the first model estimated whereas the second column presents the odds ratios of the model. Explanatory variables included in the model are: breastfeeding, place of delivery, a dummy variable indicating whether the mother received any prenatal care, the duration of prenatal care received by the mother, inter-birth intervals, interaction of inter-birth intervals with the wealth index of the family, wealth index, mother's age when she gave birth to the index child, interaction of mother's education level and gender with age of the infant, water source, region where the household lives, whether the family lives in rural or urban area, ethnicity, birth order, birth year, and the age of the infant in months. Interaction of inter-birth intervals with wealth index is included in the model in order to verify the impact of these variables among infants from families of different socio-economic statuses. Inclusion of these variables gives us chance to analyze the sibling competition effect on infant mortality risk. Moreover, correlation between infant mortality risk and prenatal care, gender and education level of mother at different stages of the infants' lives these variables are interacted with selected age intervals. Hence, the correlation between these variables and infant mortality risk is differentiated for the infants that are just born and for the infants between the ages 0-11 months.

In the remaining of this part of the study the impacts of the variables of interest on infant mortality are discussed separately.

**Table 5-2 Logit estimate results for infant mortality for second specification**

| | Coefficient | Odds Ratio |
|---|---|---|
| **Breastfeed** | -6.674*** | 0.001*** |
| | [1.023] | [0.001] |
| **Place of delivery (Base category: Government hospital)** | | |
| **Home** | 0.363 | 1.437 |
| | [0.284] | [0.409] |
| **Health centre/Health house/ Maternity house** | 0.283 | 1.327 |
| | [0.301] | [0.400] |
| **MCHFP centre/ other public** | -0.776 | 0.460 |
| | [0.611] | [0.281] |
| **Private hospital/clinic/doctor** | -1.383* | 0.251* |
| | [0.792] | [0.198] |
| **Other** | 3.419*** | 30.549*** |
| | [0.526] | [16.067] |
| **Prenatal care (Base category: No prenatal care)** | | |
| **Take prenatal care * age(00)** | -1.590 | 0.204 |
| | [1.221] | [0.249] |
| **Take prenatal care * age(0 - 11)** | -0.456 | 0.634 |
| | [0.642] | [0.407] |
| **Duration of prenatal care * age(00)** | 0.263* | 1.301* |
| | [0.158] | [0.205] |
| **Duration of prenatal care * age(0 - 11)** | -0.047 | 0.954 |
| | [0.086] | [0.082] |
| **Inter-birth intervals** | | |
| **Short preceding birth interval** | 1.162 | 3.198 |
| | [0.970] | [3.101] |
| **Short preceding birth interval * wealth** | -2.982 | 0.051 |
| | [3.763] | [0.191] |
| **Occurrence of conception** | 0.135 | 1.144 |
| | [0.586] | [0.670] |
| **Occurrence of conception * wealth** | 1.994 | 7.343 |
| | [1.511] | [11.094] |
| **Wealth index (Base category: Poorest)** | | |
| **Wealth index : Poorer** | 0.133 | 1.142 |
| | [0.338] | [0.387] |
| **Wealth index : Middle** | 0.252 | 1.286 |
| | [0.383] | [0.493] |
| **Wealth index : Richer** | -0.062 | 0.940 |
| | [0.463] | [0.435] |
| **Wealth index : Richest** | -0.507 | 0.602 |
| | [0.722] | [0.435] |

Table 5-2 (continued)

| | | |
|---|---|---|
| **Maternal age at child's birth (Base category : 25-29)** | | |
| **Mother's age< 20** | 1.470*** | 4.351*** |
| | [0.406] | [1.765] |
| **Mother's age : 20-24** | 0.902*** | 2.464*** |
| | [0.337] | [0.831] |
| **Mother's age : 30-34** | 0.447 | 1.564 |
| | [0.372] | [0.582] |
| **Mother's age : 35-39** | 1.176** | 3.241** |
| | [0.476] | [1.543] |
| **Mother's age>39** | 0.045 | 1.046 |
| | [0.621] | [0.649] |
| **Maternal education level (Base category: No education)** | | |
| **Primary * age(00)** | 0.339 | 1.404 |
| | [0.445] | [0.625] |
| **Primary * age(0-11)** | -0.100 | 0.905 |
| | [0.300] | [0.271] |
| **Secondary * age(00)** | -0.363 | 0.695 |
| | [1.035] | [0.720] |
| **Secondary* age(0-11)** | -0.067 | 0.935 |
| | [0.548] | [0.512] |
| **Higher* age(00)** | 1.050 | 2.858 |
| | [1.351] | [3.861] |
| **Higher* age(0-11)** | 0.573 | 1.773 |
| | [1.131] | [2.006] |
| **Gender of the index child (Base category: Male)** | | |
| **Female* age(00)** | 0.156 | 1.169 |
| | [0.479] | [0.560] |
| **Female* age(0-11)** | -0.159 | 0.853 |
| | [0.249] | [0.212] |
| **Water Source (Base category: piped into house/garden or outside house/garden** | | |
| **Public well** | 0.693 | 2.001 |
| | [0.591] | [1.182] |
| **Well in house/garden** | -0.639 | 0.528 |
| | [0.654] | [0.345] |
| **Piped surface water/spring/public fountain/ river/ stream/ pond/ lake/ dam** | 0.058 | 1.059 |
| | [0.383] | [0.405] |
| **Tanker/bottled/water station/other** | 0.378 | 1.459 |
| | [0.550] | [0.803] |
| **Region (Base category: West)** | | |
| **Region: Central** | -0.254 | 0.776 |
| | [0.401] | [0.311] |
| **Region: East** | 0.457 | 1.580 |
| | [0.405] | [0.639] |
| **Region: South** | 0.000 | 1.000 |
| | [0.484] | [0.483] |
| **Region: North** | 0.161 | 1.174 |
| | [0.522] | [0.613] |

**Table 5-2 (continued)**

| | | |
|---|---|---|
| **Type of place of residence** | | |
| **Rural** | -0.099 | 0.905 |
| | [0.425] | [0.385] |
| **Large city** | 0.235 | 1.266 |
| | [0.453] | [0.573] |
| **Small city** | -0.048 | 0.954 |
| | [0.396] | [0.377] |
| **Ethnicity (Base category: Turkish)** | | |
| **Kurdish** | 0.351 | 1.420 |
| | [0.296] | [0.421] |
| **Arabic** | 0.084 | 1.087 |
| | [0.619] | [0.673] |
| **Child order (Base category: 1)** | | |
| **2** | 0.247 | 1.280 |
| | [0.331] | [0.423] |
| **3** | 0.111 | 1.117 |
| | [0.411] | [0.459] |
| **4** | 0.395 | 1.485 |
| | [0.493] | [0.732] |
| **> 5** | 0.496 | 1.641 |
| | [0.475] | [0.780] |
| **Age interval in months (Base category: 00)** | | |
| **0** | 4.392*** | 80.787*** |
| | [0.631] | [51.001] |
| **1** | 2.564*** | 12.986*** |
| | [0.726] | [9.429] |
| **2** | 0.843 | 2.324 |
| | [0.838] | [1.948] |
| **3** | 1.876*** | 6.527*** |
| | [0.656] | [4.283] |
| **4** | 0.059 | 1.061 |
| | [0.850] | [0.902] |
| **5** | 0.384 | 1.468 |
| | [0.801] | [1.176] |
| **6** | 0.632 | 1.881 |
| | [0.787] | [1.480] |
| **7** | -0.812 | 0.444 |
| | [0.934] | [0.414] |
| **8** | -0.436 | 0.647 |
| | [0.837] | [0.542] |
| **9** | -2.385** | 0.092** |
| | [1.178] | [0.109] |
| **(10 + 11)** | -1.783** | 0.168** |
| | [0.906] | [0.152] |

**Table 5-2 (continued)**

| | | |
|---|---|---|
| **Birth year (Base category: 1999)** | | |
| **Birth year : 2000** | 0.045 | 1.046 |
| | [0.375] | [0.392] |
| **Birth year : 2001** | -0.028 | 0.972 |
| | [0.401] | [0.390] |
| **Birth year : 2002** | -0.040 | 0.961 |
| | [0.394] | [0.379] |
| **Birth year : 2003** | -0.050 | 0.951 |
| | [0.383] | [0.365] |
| **Birth year : 2004** | -2.225** | 0.108** |
| | [0.982] | [0.106] |
| **Pseudo-$R^2$** | 0.3762 | 0.3762 |

Note: The number of observations is 52,892. Robust and clustered at household level standard errors are in brackets beneath regression coefficient and odds ratio. The level of statistical significance of each estimate is indicated by ***, ** and * for the one, five and ten percent levels, respectively.

## 5.1 Breastfeeding

Breastfeeding is subject to truncation problem as mentioned before in this study. Breastfeeding is truncated if the child is dead before he/she is weaned. In order to overcome this problem length of infant's life is split into intervals and this variable is taken as a dummy variable taking value 1 if the child is breastfed during that interval and 0 otherwise. Breastfeeding is taken as 0 for all the infants at the first day of their lives. Moreover, in the first specification breastfeeding is interacted with the age of the infant and wealth index in order to see its impact at different stages of the infants' lives and for families with different economic statuses.

Table 5-3 presents the estimated coefficients, odds ratios and robust standard errors of breastfeeding at selected levels of wealth index and at different stages of infants' lives. According to this table based on the results of the first specification, breastfeeding is positively correlated with the survival chance of the infant statistically significantly at different stages of infants' lives and for families with different wealth indices. Only exception to this statement is the correlation between infant mortality risk and breastfeeding for the infants of wealthiest families before they reach third month of their lives. The association between breastfeeding and infant mortality risk is strongest for the infants of the poorest families before the age

3 months. Among these children the odds of dying are 0.004 times smaller if she/he was breastfed relative to the infants that are not breastfed, holding the other variables constant. (The coefficient is statistically significant at 1 percent level.) This ratio drops to 0.077 for the infants of wealthiest families and becomes statistically insignificant at 10 percent level.

It can be seen from Table 5-3 that the positive correlation between infant mortality risk and breastfeeding declines for the infants under age 2 months as the wealth index of the family rises. For the children between the ages 2-11 months the reverse of this statement becomes valid. For these children infants from wealthier families enjoy the benefits of breastfeeding more. Moreover, the infants from poor families suffer the lack of breastfeeding in the first 2 months of their lives more than the rest of their infancy period. However, as the wealth index of the family exceeds 0.7 infants between ages 2-11 months suffer the lack of the breastfeeding more than other infants. To give an example, among the families with wealth index 0.9 the odds of surviving for an infant between the ages 2-11 months is 27.7 times larger if this infant is breastfed. The odds ratio of surviving drops to 17.2 for an infant under the age 2 months.

**Table 5-3 Impact of breastfeeding at selected levels of wealth index**

| Wealth Index | Breastfeeding age * (00 + 0 + 1) | | Breastfeeding * age(2-11) | |
|---|---|---|---|---|
| | **Coefficient** | **Odds Ratio** | **Coefficient** | **Odds Ratio** |
| **0** | -5.412*** | 0.004*** | -2.939** | 0.053** |
| | [1.429] | [0.006] | [1.192] | [0.063] |
| **0.1** | -5.127*** | 0.006*** | -2.977*** | 0.051*** |
| | [1.113] | [0.007] | [0.980] | [0.050] |
| **0.2** | -4.842*** | 0.008*** | -3.015*** | 0.049*** |
| | [0.814] | [0.006] | [0.802] | [0.039] |
| **0.3** | -4.557*** | 0.010*** | -3.053*** | 0.047*** |
| | [0.556] | [0.006] | [0.686] | [0.032] |
| **0.4** | -4.272*** | 0.014*** | -3.091*** | 0.045*** |
| | [0.426] | [0.006] | [0.664] | [0.030] |
| **0.5** | -3.987*** | 0.019*** | -3.130*** | 0.044*** |
| | [0.527] | [0.010] | [0.745] | [0.033] |
| **0.6** | -3.702*** | 0.025*** | -3.168*** | 0.042*** |
| | [0.774] | [0.019] | [0.902] | [0.038] |
| **0.7** | -3.416*** | 0.033*** | -3.206*** | 0.041*** |
| | [1.069] | [0.035] | [1.102] | [0.045] |
| **0.8** | -3.131** | 0.044** | -3.244** | 0.039** |
| | [1.383] | [0.060] | [1.326] | [0.052] |
| **0.9** | -2.846* | 0.058* | -3.282** | 0.038*** |
| | [1.705] | [0.099] | [1.565] | [0.059] |
| **1** | -2.561 | 0.077 | -3.320* | 0.036* |
| | [2.032] | [0.157] | [1.811] | [0.065] |

Notes: These estimates are based on the estimates of Table 5-1. Robust and clustered at household level standard errors are in brackets beneath regression coefficient and odds ratio. The level of statistical significance of each estimate is indicated by ***, ** and * for the one, five and ten percent levels, respectively.

The results of the second model presented in Table 5-2 also imply that breastfeeding statistically significantly related to the infant mortality risk. In the second specification the interaction terms of breastfeeding are not included. According to the second model odds of an infant dying is 0.001 times smaller if he/she is breastfed relative to infants that not breastfed, holding other variables constant. (The coefficient is statistically significant at 1 percent level.) Breastfeeding is positively related with infants' survival chances for the infants. This result is parallel to the literature on infant mortality. In literature most of the studies also suggest positive relation between infant health and breastfeeding (Palloni and Tienda 1986; Olsen and Wolpin 1983; Murphy and Wang 2001; Rosenzweig and Schultz 1983a). However the impact of breastfeeding on infant survival does not last until the child is 2 years old as argued by Guilkey and Riphahn (Guilkey and Riphahn 1998).

## 5.2 Prenatal Care

Prenatal care is included only in the second model since it is considered to be a choice variable by parents of the child. In the second model in addition to the dummy variable indicating whether the child received any prenatal care duration of the received prenatal care is also included. Both of these variables are interacted with the age of the infant. The interacted terms of prenatal care shows the impact of prenatal care at the first day of the infant and when the infant is between the ages 0 and 11 months. Table 5-4 presents the impact of prenatal care on infant mortality for selected durations of prenatal care. As shown in Table 5-4 the impact of prenatal care changes for distinctive durations of prenatal care and at different stages of infants' lives. The impact of prenatal care on infant mortality risk at the very beginning of infant's life is statistically insignificant at 10 percent level, and this argument is true for all durations of prenatal care received. However prenatal care longer than 3 months is associated with lower infant mortality risk statistically significantly for the infants between the ages 0-11 months. The risk of dying is negatively correlated with prenatal care among the children at ages 0-11 months, after the first day of their lives. Moreover, the impact of prenatal care increases as the length of prenatal care received by the mother of the index child increases. Receiving prenatal care nine months, which means mother initiated receiving prenatal care at the beginning of the conception, has the largest impact on infant mortality at this stage of the infant's life. Among the infants between the ages 0-11 months infants whose mothers' received nine months of prenatal care opposed to infants whose mothers did not receive any prenatal care, the odds of an infant dying are 0.4 times smaller, holding other variables constant.(The coefficient is statistically significant at 5 percent level.)

Delay in seeking prenatal care is claimed to affect infant health negatively (Mark and Schultz 1982; Jewell and Triunfo 2006; Rous et al. 2004; Rosenzweig and Schultz 1983a). Rous, Jewell et al. using the information about the number of visits instead of the month of the initiation of prenatal care also suggest positive impact of a prenatal care visit on birth weight. They also claim that ignoring the endogeneity problem results in underestimated affect of prenatal care (Rous et al. 2004).

**Table 5-4 Impact of prenatal care for selected durations of prenatal care**

| Duration of Prenatal Care | Prenatal Care * age(00) | | Prenatal Care * age(0-11) | |
|---|---|---|---|---|
| | **Coefficient** | **Odds Ratio** | **Coefficient** | **Odds Ratio** |
| **1** | -1.326 | 0.265 | -0.504 | 0.604 |
| | [1.080] | [0.287] | [0.569] | [0.344] |
| **2** | -1.063 | 0.345 | -0.551 | 0.576 |
| | [0.944] | [0.326] | [0.501] | [0.288] |
| **3** | -0.800 | 0.449 | -0.598 | 0.550 |
| | [0.816] | [0.367] | [0.438] | [0.241] |
| **4** | -0.536 | 0.585 | -0.646* | 0.524* |
| | [0.700] | [0.410] | [0.385] | [0.202] |
| **5** | -0.273 | 0.761 | -0.693** | 0.500** |
| | [0.604] | [0.460] | [0.346] | [0.173] |
| **6** | -0.010 | 0.990 | -0.741** | 0.477** |
| | [0.537] | [0.532] | [0.325] | [0.155] |
| **7** | 0.253 | 1.289 | -0.788** | 0.455** |
| | [0.512] | [0.659] | [0.326] | [0.148] |
| **8** | 0.517 | 1.677 | -0.835** | 0.434** |
| | [0.534] | [0.895] | [0.349] | [0.151] |
| **9** | 0.780 | 2.182 | -0.883** | 0.414** |
| | [0.598] | [1.304] | [0.391] | [0.162] |

Notes: These estimates are based on the estimates of Table 5-2. Robust and clustered at household level standard errors are in brackets beneath regression coefficient and odds ratio. The level of statistical significance of each estimate is indicated by ***, ** and * for the one, five and ten percent levels, respectively.

## 5.3 Place of Delivery

The children are categorized into 6 groups according to the place where the delivery occurred. The first group includes the children who were delivered at home, and the second group includes the children who were born in a government hospital. The third group consists of the children who were delivered in a health centre, a health house or a maternity house. The place of the delivery for the children in the forth group is a maternal and child health and family planning (MCHFP) centre or a public place other than those described above. The children in the fifth group were delivered in a private hospital, in a private clinic or by a private doctor, and the last group includes the children who were born at a different place than the places mentioned above.

Table 5-2 presents the results of the second specification including the estimated coefficients, odds ratios and robust standard errors of the dummy variables created for each group of children according to the place of delivery. The base category includes the children who were delivered in a government hospital. The estimated coefficients of dummy variables of delivery places related to the MCHFP and private places are negative whereas the coefficients of dummy variables related to the delivery at home, at health center, maternity house or in a place other than mentioned in this study are positive. The results imply that delivering the child in a private hospital, clinic or doctor's office instead of a government hospital reduces the risk of infant mortality statistically significantly at 10 percent level. Relative to the infant who are born in a government hospital only the infants who are born in a place that is not mentioned in this study bear statistically significantly higher mortality risk. (The coefficient is statistically significant at 1 percent level.) The infants born in a private hospital, clinic or a private doctor's office are found to have the highest chance to survive among all the infants in this sample. The odds of an infant surviving are 4 times larger if the infant takes place in this group rather than he/she takes place in the group of children that are delivered in a government hospital, holding other variables constant. (The coefficient is statistically significant at 10 percent level.)

## 5.4 Maternal Age at Birth

The age of the mother when she gave birth to the index child is grouped into 6 intervals. The base category includes mothers giving birth to the index child when they were between the ages 25 and 29. Estimated coefficients of all the dummy variables are positive for both of the specifications. This means relative to the children of the mothers that gave birth to them between the ages 25 and 29 the children of mothers younger than 25 and older than 29 are subject to higher risk of dying. Relation between infant mortality risk and maternal age at birth is curvilinear. Mothers bearing child at very young and old ages are found to experience higher infant mortality risks. The differences between the infant mortality risks for the children of the mothers between the age 25-29 and for the children of the mothers younger than 25 is statistically significant at 1 percent and the difference between the infants in the base category and the infants of mothers between the age 35-39 are statistically significant at 5 percent level. The difference is highest for the mothers having children before they were 20 then. Therefore it can be stated that the children of mothers who gave birth before they are 20 bears the highest risk of dying before reaching the age 1. The results of the estimations given in Table 5-1 and Table 5-2 imply that if the mother gave birth to the index child before she was 20 opposed to the giving birth between the ages 25-29, the odds of infant dying are 5.08 times larger in the first model and 4.3 times larger in the second model, holding other variables constant. (The coefficients are statistically significant at 1 percent level.)

The results of the first and second specifications are similar, including inter-birth intervals and interaction of them with wealth index to the model does not change the impact of maternal age at birth. Both specifications suggest that teen maternity is associated with higher risks of infant mortality. Also, in both of the models evidence of commonly argued curvilinear relationship between the maternal age and infant mortality risk is found (Geronimus 1986; Maitra 2004; Bhalotra and van Soest 2008). The curvilinear relationship suggests higher infant mortality risk for the infants of mothers at very young and very old ages. However, the difference of mortality risk between the mothers at reference category and older mothers is not statistically significant at 10 percent level.

## 5.5 Mother's Education Level

In order to find out the role of maternal education on infant health at different stages of infants' lives, the education level of mother is interacted with the selected age intervals – the first day of the infants' lives and the ages between 0 and 11 months. Education of the mother may have differential impacts on the survival chances of infants at the very beginning of the infants' lives and at the later stages of infancy. Each of the dummy variable indicating the education level of the mother is interacted first with the age of the infants that are just born and then with the age of the infants at age 0-11 months. The omitted category, which includes the mothers with no education, is the base category for this variable.

Results of the first and second models are similar in terms of maternal education. According to the results presented in Table 5-1 and Table 5-2 there is no evidence that primary, secondary and higher education of mothers is associated with lower infant mortality risk statistically significantly at the very beginning of the infant's life, when the infant is just born and also at the later stages of the infant's life, after controlling the other variables. The coefficients of these variables are not statistically significant at 10 percent level.

In the literature mother's education is found to be associated with infant health (Caldwell 1979; Hobcraft 1993; Davanzo and Habicht 1986; Jain 1985). Majumder, May and Pant (1997) using Bangladesh data find negative correlation between infant mortality and parental education. They also claim that maternal education was more important than father's education level. However, there are also studies that find weak relationship between maternal education and infant mortality risk. As mentioned in the literature survey chapter of this study, Hobcraft finds the correlation between infant health and maternal education is weak for sub-Saharan Africa countries. One of the reasons of this weak relationship is claimed to be low level of health infrastructure. This might be the reason that prevents the educated mothers to take advantage of their knowledge also in Turkey.

## 5.6 Gender

Differential effect of the gender on the infant health at different stages of the life is allowed by including interaction of the dummy variable used to specify the gender with the age of the infant. Similar to the education level of the mother, female dummy is interacted with the age zero and with the age interval 0-11 months. This allows us to identify the impact of gender at the very beginning of life from its impact at the later stages of infant's life.

The estimated coefficients of the interaction terms of gender with age of the infant are very close in both of the specifications. In the first model, the coefficient of the dummy variable related to female infants is negative for the infants that are recently born. However, being female does not statistically significantly reduces the risk of dying for these children at 10 percent level. This result is valid for both of the models. For the children between the age 0-11 months the coefficient turns out to be positive but it is also statistically insignificant at 10 percent level.

Gender is an exogenous variable if selective abortion is not the case. Taking prenatal inputs independent of the gender of the child, the impact of the sex of the infant on mortality risk at birth becomes only biological. The negative relation between the mortality risk at birth and being female may be due to the biological strength of the female babies relative to the male infants. The findings of the studies are similar to this analysis (Olsen and Wolpin 1983; Majumder et al. 1997). The results of study conducted by Majumder, May and Pant (1997) imply that infant mortality rate is higher for male children but male children become more advantageous between the ages 1-5, when child mortality is examined. Whereas, Bhalotra and van Soest (2008) find that the impact of gender on neonatal mortality is insignificant.

Information of postnatal inputs is missing in the data therefore they cannot be controlled in this study. Omitting these variables from the model avoids us to take into account the effect of the male preference of the families on infant mortality risk. Dummy variable of the gender interacted with the age of the infant after the birth may be biased because of the omission of health inputs allocated to infants after the birth. If the families have greater preference for male children they tend to allocate more resources to the male infants. The difference in resource allocation may lead to underestimation of the effect of gender on infant health.

## 5.7 Ethnicity

The most populated ethnic groups living in Turkey are the Turkish, the Kurdish and the Arabic. In order to identify the difference in infant mortality risk among these groups dummy variables related to ethnic Kurdish people and ethnic Arabic people are included in the model. The group of ethnic Turkish people is taken as the reference category.

In the first model the coefficient of the dummy variables for the ethnic Kurdish families is positive implying higher infant mortality risk among these families relative to infant mortality risk among ethnic Turkish families. The odds of an infant dying are 1.7 times larger if the infant's family is ethnic Kurdish rather than his/her family is ethnic Turkish, holding all other variables constant. (The coefficients are statistically significant at 1 percent level.) The coefficient of dummy variable for ethnic Arabic people is very close to zero implying that the mortality risk among children under age 1 is very close for these families.

After including inter-birth intervals, place of delivery and prenatal care the negative correlation between survival chance of infant and being ethnic Kurdish declines and becomes statistically insignificant at 10 percent level.

## 5.8 Wealth

Wealth cannot have a direct impact on infant mortality risk as mentioned in Chapter 2. Wealth can influence infant's health through the inputs purchased using the financial resources of the family. However due to the data restrictions all the inputs in correlation with infant mortality cannot be included in the model. Hence, as a proxy indicator of financial resources wealth of the households is included in both of the specifications to account for omitted relevant variables in the model.

Wealth index is grouped into 5 categories from the poorest households to the richest. In order to see the impact of wealth on hazard of infant mortality dummy variables of each group except dummy variable for the poorest group is included in the model. The families at the poorest group are taken as reference category. In the first model, the coefficients of the dummy variables of wealth indices are negative and increase in absolute terms. This implies that increasing levels of wealth is associated with decreasing levels of infant mortality risk. However, the results of the first model in Table 5-1 indicate that only infant mortality risk among richest families is statistically significantly lower than the infant mortality risk among the poorest families. The odds of an infant surviving are 3 times larger if the infant comes from the richest group relative to the poorest group. (The coefficient is statistically significant at 10 percent level.) In the second model none of the dummy variables related to the wealth of the family is statistically significant.

Correlation between the wealth of the family and prenatal care and place of delivery might lead to the statistical significance of the coefficient of the dummy variable of the richest group. If the richer families are more likely to acquire longer durations of prenatal care, which is found to improve chance of infant mortality, and they are more likely to deliver their children in private hospital omission of these variables will result in overestimation of the effect of wealth on infant survival chance. Therefore including place of delivery and prenatal care to the second model might have resulted in the coefficient of wealth variables to be statistically insignificant.

These findings suggest positive correlation between infant health and financial resources of the household (Hong et al. 2007; Mark and Schultz 1982; Singh and Yu 1995; Christopher 1998). However, the results of the study conducted by Wolfe and Behrman suggest that income is not an important factor in determining child morality (Wolfe and Behrman 1982).

## 5.9 Previous Birth Interval

Previous birth interval is considered as short if the birth interval between the index child and his/her older sibling is shorter than 14 months and the infant is not the first child. First children are taken as if they are in the favorable group with preceding birth interval longer than 13 months. Pace of childbearing may not be independent of the parents' choices. This is the reason of not including preceding birth interval and interaction of short preceding birth with wealth index in the first model.

Inter-birth intervals are thought as one of the important determinants of infant mortality therefore dummy variables indicating short preceding birth interval and interaction of short preceding birth interval with the wealth index are also included in the second specification. The estimated coefficients are presented in Table 5-2. The results imply that among the poorest families in the data – families with wealth index 0 – the difference between the infant mortality risk of children with short preceding birth interval and the infant mortality risk of the children with preceding birth interval longer than 13 months is not statistically significant.

Preceding birth interval is argued to be correlated to infant mortality through three ways as explained in the literature survey. One of these ways is competition between the siblings. The restricted resources of the family have to be shared among the children. Fewer resources may be correlated with infant mortality therefore short preceding birth interval may increase the risk of infant mortality. The different levels of resources available to the family – measured by wealth in this study – may lead to differential effects of preceding birth interval on infant mortality risk. If this proposition holds we would expect decline in the positive correlation between short preceding birth interval and infant mortality with the increasing wealth indices of the families. The negative coefficient of interaction of short preceding birth interval with wealth index suggests the positive association between short preceding birth interval and infant mortality risk to decrease as the wealth of the family increases. This result can be seen in Table 5-5 which presents the estimated coefficients, odds ratios and robust standard errors of short preceding birth interval for the infants at selected values of wealth indices. According to the results presented in Table 5-5 short preceding birth interval is positively correlated with hazard of dying for the infants at ages 0-11 months of the families having wealth index under 0.4, and this positive correlation decreases as the wealth index of the family increases. The correlation turns out to be negative when the wealth index of the family exceeds 0.3 Therefore, the evidence of sibling competition effect is found in this study which increases infant mortality risk through the short preceding birth interval. The odds of an infant dying among the families with wealth index 1 are 0.16 times smaller if he/she was preceded by a sibling not more than 13 months before compared to the other infants, whereas odds ratio is 3.2 for the poorest families as mentioned above. However, the coefficients are not statistically significant at 10 percent level.

Using Turkey data the interval between the index child and his/her preceding sibling is found to be positively correlated with hazard of dying before the age 1 for the infants of poor families. This result is similar to the result of the studies conducted for other countries which state longer preceding birth interval is associated with higher mortality risk (Majumder et al. 1997; Palloni and Tienda 1986; Pebley and Stupp 1987).

**Table 5-5 Impact of preceding birth interval at selected levels of wealth index**

| Wealth Index | Short preceding birth interval (Preceding Birth Interval <14) | |
|---|---|---|
| | **Coefficient** | **Odds Ratio** |
| **0** | 1.162 | 3.198 |
| | [0.970] | [3.101] |
| **0.1** | 0.864 | 2.373 |
| | [0.654] | [1.552] |
| **0.2** | 0.566 | 1.761 |
| | [0.445] | [0.784] |
| **0.3** | 0.268 | 1.307 |
| | [0.501] | [0.656] |
| **0.4** | -0.030 | 0.970 |
| | [0.767] | [0.744] |
| **0.5** | -0.328 | 0.720 |
| | [1.099] | [0.791] |
| **0.6** | -0.627 | 0.534 |
| | [1.453] | [0.776] |
| **0.7** | -0.925 | 0.397 |
| | [1.816] | [0.720] |
| **0.8** | -1.223 | 0.294 |
| | [2.183] | [0.643] |
| **0.9** | -1.521 | 0.218 |
| | [2.553] | [0.558] |
| **1** | -1.819 | 0.162 |
| | [2.925] | [0.474] |

Notes: These estimates are based on the estimates of Table 5-2. Robust and clustered at household level standard errors are in brackets beneath regression coefficient and odds ratio. The level of statistical significance of each estimate is indicated by ***, ** and * for the one, five and ten percent levels, respectively.

## 5.10 Birth of the Succeeding Sibling

The impact of interval between the index child and his/her succeeding sibling is measured by using a dummy variable that takes value 1 if the mother becomes pregnant before the index child entered the age interval considered. This variable is also interacted with wealth index of the household. The logic behind using the interaction term is similar to that of interaction term of preceding birth interval with wealth index. Competition between the siblings is thought to affect infant mortality also through succeeding birth interval. In addition to indirect competition through scarce resources mother may decide to stop breastfeeding because of the beginning of a pregnancy; this would result in indirect competition (Koenig et al. 1990).

Coefficients of the dummy variable related to the conception of the succeeding sibling and the interaction term are positive indicating a positive and increasing correlation between the conception of the succeeding child and mortality risk of the index child with the increasing level of family's wealth. However the coefficients are not statistically significant at 10 percent level.

Table 5-6 presents the estimated coefficients of the succeeding birth interval at selected levels of wealth indices. Opposite to the preceding birth interval evidence of sibling competition is not found for the conception of the succeeding child. Therefore it can be argued that the impact of conception of succeeding sibling on infant mortality do not operate through competition effect. Our results differ from the results of the study conducted by Palloni and Tienda (1986) which suggest that longer following birth intervals would be advantageous and this advantage would be stronger if the resources available to the family are scarce. The positive correlation between succeeding birth interval and infant mortality risk is suggested also by other researches (Bhalotra and van Soest 2008; Pebley and Stupp 1987).

**Table 5-6 Impact of succeeding pregnancy for selected levels of wealth index**

| Wealth Index | Occurrence of conception | |
|---|---|---|
| | **Coefficient** | **Odds Ratio** |
| **0** | 0.135 | 1.144 |
| | [0.586] | [0.670] |
| **0.1** | 0.334 | 1.397 |
| | [0.483] | [0.675] |
| **0.2** | 0.534 | 1.705 |
| | [0.412] | [0.702] |
| **0.3** | 0.733* | 2.081* |
| | [0.388] | [0.808] |
| **0.4** | 0.932** | 2.540** |
| | [0.422] | [1.072] |
| **0.5** | 1.132** | 3.101** |
| | [0.501] | [1.553] |
| **0.6** | 1.331** | 3.785** |
| | [0.608] | [2.300] |
| **0.7** | 1.530** | 4.620** |
| | [0.730] | [3.374] |
| **0.8** | 1.730** | 5.640** |
| | [0.862] | [4.862] |
| **0.9** | 1.929* | 6.884* |
| | [0.999] | [6.879] |
| **1** | 2.129* | 8.403* |
| | [1.140] | [9.579] |

Notes: These estimates are based on the estimates of Table 5-2. Robust and clustered at household level standard errors are in brackets beneath regression coefficient and odds ratio. The level of statistical significance of each estimate is indicated by ***, ** and * for the one, five and ten percent levels, respectively.

## 5.11 Birth Order

In this study the birth order of the index child is included as dummy variable. Birth order is categorized into 5 groups. The last group includes fifth and the higher ordered children of the mothers. Other groups include first, second, third and forth children of the mothers. The reference category for this variable includes the first children of the mothers.

The dummy variables related to the birth order of the index child are included in both of the specifications. These coefficients are positive meaning that the first child of the mother bears lower risk of mortality until they reach age 1 than other children of the same mother, holding other variables constant. In the first model except the coefficient of the dummy variable corresponding to the third child of the mother coefficients are statistically significant at 10 percent level. The odds of an infant dying are 1.7, 3.6 and 2.3 times higher if the child order is two, four or greater than four compared to one respectively. The results also states that when place of delivery, prenatal care, inter-birth intervals and interaction of inter-birth intervals with wealth index is included in the model coefficients of birth order dummy variables decrease. The impact of birth order on infant mortality decreases in the second model. The odds ratio drops to 1.5 for the fourth child and to 1.6 for the fifth and higher ordered children. Also the coefficient of the dummy variables becomes statistically insignificant at 10 percent level in the second model.

Rosenzweig and Schultz also find positive correlation between birth order and infant mortality when they estimate the model using OLS. However, the impact turns out to be negative after controlling endogeneity of the model by TSLS method (Rosenzweig and Schultz 1983a). The impact of birth order is found to be insignificant by Bhalotra and van Soest (2008).

## 5.12 Source of Water

Water source is believed to reflect the environmental contamination and serve as a proxy for variables that are not available like household hygiene and cleanliness standards of the family (Omariba et al. 2007a). It is thought that water source influences infants' health both directly and indirectly through omitted variables that are correlated with water source and infant mortality. Access to safe water may be correlated with some other inputs that affect infant mortality risk and are not included in the model.

In this study source of water which the household uses is categorized into 5 groups. The base category includes households that use water that is piped into their house/garden or outside their house/garden. Results of the study imply that families in this category bear the lowest risk of infant mortality following the families using water from the well in their house. Using well in house as water source is found to decrease infant mortality risk relative to the base category in both of the models. However, only the families using water from public well experience higher infant mortality rate than the families in the reference category statistically significantly in the first model. (The coefficient is significant at 5 percent level.)

Using Malaysian data Davanzo and Habicht studied the factors contributed to the decline in infant mortality between 1946-1960 and 1961-1975. Holding the structural model constant between the two sub-periods they find that one of the most important contributions to this decline is the increase in usage of piped water of mothers who do not breastfeed their children (Davanzo and Habicht 1986). However, in a study conducted to examine the determinants of infant and child mortality in Kenya water source is found to be statistically insignificant (Omariba et al. 2007a). As an explanation to this result it is claimed that more than the source of water conditions of using it would be more important.

## 5.13 Other Variables

As well as the variables mentioned so far some other child and household specific characteristics are included in both of the specifications. Included household level characteristics are the region where the family lives, whether the family lives in an urban or a rural area, in a large or small city. Other than the child specific variables explained above birth year and age of the infant are used in this analysis. Coefficient estimates and robust standard errors of these variables are presented in Table 5-1 and Table 5-2.

Turkey is divided into 5 regions as explained in the third chapter. The base category includes households from West region. The estimated coefficients of all the regions are positive in both of the models. This means relative to West region, families living in other regions of Turkey has higher risk of experiencing infant mortality. However the difference is found to be statistically insignificant for all regions in both of the specifications at 10 percent level. The region where the family lives is found to have no statistically significant impact on infant mortality, holding other variables constant.

The variables of household's type of place of residence – whether the family lives in an urban or a rural area, in a large or a small city – are found to be statistically insignificant at 10 percent level.

Birth year dummies are also included in the models. The children born in 1999 are taken as base category. The estimation results indicate that the birth year of the infant is negatively associated with infant mortality risk. The children born recently bear significantly lower risk of dying before they become 1 year old. In the first and second models coefficients of dummy variables for the children born in 2004 are statistically significant at 5 percent level. The probable reason of this negative correlation is the age of the infants born in 2004 that are included in the sample. These children are at most 5 months old at the date of the survey therefore they still bear risk of dying in infancy.

In the last chapter of this survey the concluding remarks will be mentioned and the future work will be indicated.

# CHAPTER 6

# CONCLUSIONS AND FUTURE WORK

The aim of this study is to throw a light on the regional, household and individual level factors that are associated with the mortality among the children under the age one in Turkey. For this purpose data from Turkey Demographic and Health Survey conducted by Hacettepe University Institute of Population Studies in 2003-2004 is used. The method employed to model the determinants of infant mortality risk is survival analysis. Data includes birth histories of the women in the survey, so the information on sibling. Genetic factor shared by the siblings, behavioral customs of the parents and being raised in the same environment will result in correlation of mortality risks of the siblings (Dasgupta 1990; Guo and Rodriguez 1992; Curtis et al. 1993). In order to account for this correlation children are clustered according to their mother.

Information of the duration of breastfeeding, prenatal care received by mother and place of delivery does not exist for the children born before 1999. In order to examine the correlation between these variables and infant mortality risk the children born before were excluded from the data. Restricting the data to the children born last 5 years before the survey prevents the selection bias – caused by observing women under 50 in the data – and makes the assumption of similar household and regional conditions at the date of the child's birth more reliable. Moreover, using the entire sample requires a strict assumption of stable parameters for 37 years.

In this study two specifications are estimated. In the first specification only the variables that are assumed to be exogenous are included. However, in the second specification variables that might depend to the choices of the parents like the birth intervals between the infants, prenatal care received by mother, place of delivery are also included.

Using the restricted sample – children born after 1998 – breastfeeding, maternal age at birth, place of delivery, prenatal care and birth year are found to be correlated with infant mortality risk.

Breastfeeding is found to be negatively correlated with infant mortality risk at all stages of wealth levels and at all stages of infancy. Moreover, in the first two years of infants' lives this negative correlation is found to decrease as the wealth level of the families rises. Therefore it can be inferred that for the children that are not breastfed have to be given good substitute of breastfeeding as nutriment. Breastfeeding is claimed to be nutritional, clean and hygienic and to provide immunity to the infants. Hence, the nutriments used instead of breastfeeding are required to have these characteristics in order to be referred as a good substitute of mother's milk. Moreover, these substitutes can be made available for the lower income households. These suggestions may be implemented as policy instruments in order to improve infant health in Turkey.

The curvilinear association found between infant mortality risk and maternal age at birth is in parallel with the findings in literature (Geronimus 1986; Maitra 2004; Bhalotra and van Soest 2008). After controlling for the other variables, especially for the mothers having child before age 20 relative to the ages between 25 and 29, risk of experiencing infant mortality is very high. Delaying the age of child bearing might be another probable way of improving infant health. Extending the usage of contraception especially among teenagers would prevent early child bearing to some extent.

In this study, after controlling the other variables infants born in a private hospital, in a private clinic or in a private doctor's office are found to experience statistically significantly lower infant mortality risk than the infants born in a government hospital.

Longer duration of prenatal care received by the mother is associated with higher chance of infant survival for the children between the ages 0-11 months but is not correlated with the risk of dying at birth of the child. Therefore making the prenatal care prevalent among the pregnant women might be another way to improve infant survival chance in Turkey. Then, a public policy that enables all the mothers to receive long durations of prenatal care may be concluded with lower infant mortality rates.

In terms of wealth index only the difference between infant mortality risks among the poorest and richest families is found to be statistically significant in favor of wealthiest group in the first specification. However, after the inclusion of place of delivery, prenatal care and inter-birth intervals the statistically significance of this difference disappears. Correlation between health inputs and wealth index may the cause of the result of the first specification. The difference of infant mortality risks between the families using piped water and using water from public well is also found to be statistically significant in favor of families using piped water in the first model, but not in the second.

In this study after controlling all the other parameters any level of education of mother is found to not matter for the survival status of the infant. Families using water from public well are observed to be the worst in terms of infant mortality risk. Gender gap is also not statistically significant in this analysis. Finally, the negative correlation between birth order and infant’s survival change becomes insignificant after the inclusion of prenatal health inputs, place of delivery and inter-birth intervals to the model.

As a future work, determinants of mortality risk among children between the ages 1-4 in Turkey in addition to the determinants of infant mortality risk can be analyzed. Factors associated with child mortality risk might be different than those associated with infant mortality. Therefore explanatory variables other than the ones used in this study can be included to the model.

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