Hacettepe University Graduate School of Social Sciences

Faculty of Economics and Administrative Sciences

Department of Economics

FACTORS AFFECTING INFANT MORTALITY RATES IN TURKEY: A GEOGRAPHICAL REGION ANALYSIS

Semih YILMAZ

Master's Thesis

Ankara, 2019

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ACCEPTANCE AND APPROVAL

The jury finds that Semih Yılmaz has on the date of 31/05/2019 successfully passed the defense examination and approves his Master's Thesis titled "Factors Affecting Infant Mortality Rates in Turkey: A Geographical Region Analysis".

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ABSTRACT

YILMAZ, Semih. Factors Affecting Infant Mortality Rates in Turkey: A Geographical Region Analysis, Master's Thesis, Ankara, 2019.

The primary aim of the study is to reveal socio-economic factors that may have an effect on infant mortality rates. For this purpose, the development of infant mortality rates in the historical process has been examined and its importance in development goals has been put forward. Factors affecting infant mortality rates were evaluated and empirical analyzes were performed according to the level of development of countries and factors the most affecting infant mortality rates were determined. The reasons for the differences in infant mortality rate data sets are presented. Infant, neonatal and postneonatal mortality rates were investigated according to the First Level of Statistical Regions prepared by Turkish Statistical Institute. The infant mortality rate in Turkey is subject to the classification of regional discrimination has been revealed that the structure of infant mortality is similar to the situation in developed countries. The socio-economic factors impact on infant mortality are estimated by using panel data method and data of each provinces in Turkey for 2009-2014 period. According to the results of the study, infant mortality rate is mostly affected by the age factors which represent age of marriage of women and men. In addition, size of household is one of the factors affecting infant mortality rate. The number of persons per physicians and midwife are significant variables affecting the infant mortality rate. Education of women, as a education factor, is one of the important factors reducing the infant mortality rate. In this study, it was revealed that the marriages in middle ages and the education of women were the most influential variables in decreasing infant mortality rates.

Keywords

Infant Mortality Rate, Development Goals, Statistical Regions, Panel Data.

ÖZET

YILMAZ, Semih. Türkiye'de Bebek Ölüm Hızlarını Etkileyen Faktörler: Bir Coğrafi Bölge Analizi, Yüksek Lisans Tezi, Ankara, 2019.

Çalışmanın öncelikli amacı bebek ölüm hızları üzerinde etkili olabilecek sosyo-ekonomik faktörleri ortaya koymaktır. Bu amaçla bebek ölüm hızlarının öncelikle tarihsel süreçte gelişimi incelenmiş ve kalkınma hedefleri içerisindeki önemi ortaya konulmuştur. Bebek ölüm hızlarını etkileyen faktörler ele alınmış ve ülkelerin gelişmişlik düzeylerine göre oluşturulan ampirik analizler incelenerek bebek ölüm hızlarını en çok etkileyen faktörler saptanmıştır. Bebek ölüm hızı veri setlerindeki farklılıkların nedeni ortaya konulmuştur. Türkiye İstatistik Kurumu'nun birinci düzey istatistiki bölge birimleri sınıflamasına göre bebek ölüm hızı, neonatal ölüm hızı ve postneonatal bebek ölüm hızı incelenmiştir. Bölgesel ayrıma tabi tutulan sınıflamada Türkiye'deki bebek ölüm hızı yapısının gelişmiş ülkelerdeki duruma benzer olduğu ortaya koyulmuştur. 2009-2014 yılları arasında sosyo-ekonomik faktörlerin bebek ölüm hızı üzerindeki etkisi, il düzeyinde veri seti ve panel veri analizi metodu ile sınanmıştır. Çalışmanın sonuçlarına göre, bebek ölüm hızını en fazla yaş faktörlerini temsil eden kadının ve erkeğin evlilik yaşları etkilemektedir. Bunun yanında hanehalkı büyüklüğü de bebek ölüm hızını etkileyen faktörlerden biridir. Sağlık arzı faktörlerinden hekim ve ebe başına düşen kişi sayısı da bebek ölüm hızını etkileyen anlamlı bir değişken olarak çıkmıştır. Eğitim faktörü olarak kadının eğitimi bebek ölüm hızını azaltan önemli faktörlerden biridir. Yapılan bu çalışmada orta yaşlarda yapılan evliliklerin ve kadının eğitiminin sağlanmasının bebek ölüm hızlarını azalmasını en çok etkileyen değişkenler olduğu ortaya koyulmuştur.

Anahtar Sözcükler

Bebek Ölüm Hızı, Kalkınma Hedefleri, İstatistiki Bölge Birimleri Sınıflaması, Panel Veri.

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ABBREVIATIONS

IBRD: International Bank for Reconstruction and Development

IDA: International Development Association

IMR: Infant Mortality Rate

LBW: Low Birth Weight

MDGs: Millennium Development Goals

MH-HSY: Ministry of Health – Health Statistics Yearbook

MMR: Measles-Mumps-Rubella Vaccination

NICU: Neonatal Intensive Care Unit

NMR: Neonatal Mortality Rate

NTMC: National Turkish Medical Congress

OECD: The Organization for Economic Co-operation and Development

PMR: Postneonatal Mortality Rate

SDGs: Sustainable Development Goals

SIDS: Sudden Infant Death Syndrome

TDHS: Turkey Demographic and Health Survey

TURKSTAT: Turkish Statistical Institute

U5MR: Under Five Mortality Rate

UNDP: United Nations Development Program

UNICEF-SOWC: United Nations International Children's Emergency Fund – The State of World's Children Reports

WHO-WHS: World Health Organization- World Health Statistics

VIF: Variance Inflation Factor

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INTRODUCTION

Infant mortality rate (IMR) is an indicator of the overall health level of the population, but also a good measure of the country's development levels. IMRs provide guidance on the regulation of the content of health programs and on the establishment of relevant policies. Reducing the IMR is one of the health goals of every country in the world, but also constitutes one of the United Nations Development Goals. IMRs are affected by many factors. It is also a good indicator because it contains the effects of many factors. It shows the level of development indirectly while showing the health level of a country. Low IMRs are also a measure of general living conditions, social welfare, disease rates and environmental quality.

There are many indicators of mortality. Neonatal, postneonatal, perinatal, child and under-five mortality rates are used as mortality indicators apart from IMR. The neonatal mortality rate (NMR) gives the number of infants who died within one month (28 days) per one thousand live births. It is separated into two categories. The early neonatal includes period from birth to first seven days. The late neonatal includes period from seventh day to one month. The postneonatal mortality rate (PMR) is the number of deaths between one month (29th days) and one year per a thousand live births. IMRs are the sum of NMR and PMR. So, “the IMR is the number of deaths of children less than one year of age per a thousand live births. The child mortality rate is the number of deaths of children between the first and fifth birthdays per a thousand live births, while the under-five mortality rate (U5MR) is the number of deaths of children before the five years of age per a thousand live births” (Hacettepe University Institution of Population Studies, 2014: 130). Infant mortality and child mortality also account for deaths under the age of five years. Under five mortality rates is more commonly used in international literature compared to child mortality. “The perinatal mortality rate is acquired by adding the number of the babies who are born alive and die in seven days (early neonatal) in a year in a society to the number of the dead births in the same year and it is divided by the number of total births (live+dead) in the same year and multiplied by a thousand” (The Republic of Turkey Ministry of Health, 2018: 32) NMR, IMR and U5MR are generally used for comparison of countries. In this study, there are several reasons why IMRs are used instead of other similar mortality rates.

Murray (1988) attributed the fact that IMRs are one of the most frequently used indicators in medicine, sociology, economics, geography, demography and development studies. According to Murray (1988), there are two reasons behind this assumption. First, IMRs are highly correlated with other health indicators. For this reason, it can be said that they are more reliable than all

mortality index and life expectancy data. The second reason is that IMRs better reflect changes in health systems and socio-economic environment compared to other mortality rates.

There are also studies stating that IMRs are the most appropriate criteria to show the health level of the population. Socio-economic, environmental and medical interventions that reduce IMRs also reduce other mortality rates (Fuchs, 2011). In addition, it is stated that it is the most appropriate measure to compare with factors that are not related to health system (Nixon & Ulmann, 2006).

NMRs are included within the scope of health objectives along with IMRs in the Millennium Development Goals (MDGs). It continues to be a criterion under the Sustainable Development Goals (SDGs). However, IMRs have been considered appropriate in this study because IMRs include both the neonatal and postneonatal process which cause infant mortality.

Under five mortality rates (U5MRs) are also used as health indicators. Child deaths under the age of five are used as a health measure both in MDGs and SDGs. When the World Health Statistics (WHS) reports published by "the World Health Organization (WHO)" are examined, IMRs constitute at least 85% of U5MR. "In 2017, 5.4 million children died under five years of age. 2.5 million of these children died within the first month after birth (neonatal period). In 2017, the share of NMR in U5MR was 47%. In 1990, this rate was 40%" (The World Health Organization, 2018e). Thus, it is seen that the share of NMR in U5MR increases overtime.

IMR in Turkey is lower than the world average in 2017 according to World Bank Data. IMR was 29.4 per thousand in the world, while IMR in Turkey is 10 per thousand level. The lowest group belongs to the European Union (3.45 per thousand). The average of OECD countries is 5.70 per thousand. Latin American countries (14.9 per thousand), Middle Eastern and North African countries (19.3 per thousand) and the Arab World (27.61 per thousand) are below the world average. The highest IMR belongs to the Sub-Saharan Africa compared to 51.55 per thousand (The World Bank, 2019g). Turkey has a higher IMR compared to European Union and OECD countries.

The IMR data extend from 1960 to 2017 for Turkey in The World Bank Database. Data indicate a decreasing trend in IMRs. A decrease of 3.67% in IMRs from 1960 to 1990; 5.46% reduction between 1990 and 2003. There is a reduction by 6.66 % from 2003 to 2017 (The World Bank, 2019i). IMR in Turkey is above Europe and the OECD averages although IMR continues to decrease. More active policies are needed to reach the level of developed countries. In this respect, infant deaths in Turkey is still a problem.

The subject of this study is to reveal the factors that affect IMR in Turkey. Second is to examine the IMR by statistical regions in Turkey. Third is to analyze the effect of socioeconomic factors on IMRs by using panel data analysis method.

The scope of this thesis is to be able to make an assessment of the situation between the years 2009-2014 with the usage of factors data that has been constructed according to 81 provincial levels. The contribution of this study to the literature is to expose the profile of the IMR in Turkey and to analyze the effect of socio-economic factors whose datasets to be formed at province level.

This thesis is organized as follows: The next chapter is devoted to the progress of IMR in the historical process and IMR in development goals. In chapter 2, the factors affecting IMRs and child health will be specified, and the IMRs will be examined by differentiating three categories according to the development levels of the countries: developed countries, developing and less developed countries and Turkey. In chapter 3, differences in IMRs in data sets of different institutions have been presented. Besides the infant mortality in statistical regions of Turkey are presented. In chapter 4, socioeconomic factors that may affect infant mortality were given and panel data analysis was performed. Estimation results are interpreted. In conclusion, the results of thesis are interpreted.

CHAPTER 1

THE PROGRESS OF IMR IN THE HISTORICAL PROCESS & IMR IN DEVELOPMENT GOALS

1.1. DEVELOPMENT OF INFANT MORTALITY RATES IN HISTORICAL PROCESS

The most prominent factor in development of societies in terms of economic and social improvement, is the skilled and healthy manpower of that society. Individuals must be healthy for the society to have skilled manpower. A healthy population will have an impact on the development of countries, management of natural resources, the expansion of the political and cultural spheres of influence, and the increased development of production and consumption. Human capital is also important in this sense. Human capital is defined as a type of capital that includes features such as health, knowledge, skills and abilities that make a person useful and productive. Increasing the amount of human capital in a healthy society is easier than in other societies. Therefore, health capital is seen as an element that increases human capital. This positive effect of health capital on human capital shows that it is an important and indispensable element of human capital. In this respect, reducing IMR is used as a development indicator that positively affects health capital.

1.1.1. Historical Situation

In the last years of the Ottoman Empire (1912-1922), the wars that continued uninterruptedly led to economic and social destruction in the society. Being impoverished, the wars surrounding all parts of the country, and the struggle for the War of Independence, which covers the last 5 years, led to the loss of human power in Anatolia and a difficult process to recover from. The number of people who died between 1911 and 1922 was approximately 2.5 million (McCarthy, 1998).

The high mortality rates caused by malaria, cholera and typhoid diseases as a side effect of wars led to the poor status of health conditions and reduces the probability of living infants. Historically, it is difficult to distinguish infant deaths from child deaths because of data unavailability. However, it is accepted that the rate of death among children who are breastfed is

20-30% in Europe at the beginning of the 19th century, but this rate is reduced to 10% in the early of the 20th century (Yellice, 2007: 17).

Distinguishing infant and child deaths is quite difficult in the early Republican period. Although there are no definitive records, data on this subject are also available. Fuat Umay, the founder of the Himaye-i Etfal (Child Protection Association), visited the four villages so he recorded 402 births, 233 losses (55%). Deaths were caused by neglect, hygiene issues, ignorance and disease (Malkoç, 2018: 41).

Camille Jacquart's Kalecik survey showed that 789 mothers brought 3469 children and 1686 of them died in 1927, with the increasing debate about what child deaths were. According to these data, the rate of birth to death was 48.6%. In addition, Fuat Umay recorded 199 of 607 children have lost in a small questionnaire with 130 deputies. Death rate was 33% in intelligentsia (Malkoç, 2018: 42).

A census was conducted on the death of children in Mersin in 1927. It was determined that 1719 out of 4904 children were dead before they reached the age of 10. Therefore, the mortality rate was 35%. Again, in the same analysis, the mortality rate below one year of age was 18.7% and the losses until the age of two were at 24.6% (Malkoç, 2018: 48).

At the second congress of Himaye-i Etfal, it was stated that the infant death, which is for the first year of life, is 70%. Besides, 757 of 1334 children died and almost all of them were malaria as a result of the survey conducted in 12 villages around Ankara. Although the child mortality rate was 57%, it was certain that some of the inhabitants would die later. There was no population increase in the villages. On the contrary, it was stated that the population decreased (Malkoç, 2018: 42). According to the report of the Himaye-i Etfal presented to Turkish Medical Congress, the mortality rate for infants up to one year of age, is 757.4 per thousand (Malkoç, 2018).

There were shortcomings in the calculation of child mortality. Since the public did not inform the authorities about the birth and death, survey method had to be used. While the time of death of the child was important in the calculations, the fact that death was not transmitted to the authorities made it impossible to calculate the correct calculations. Although there were deficiencies in the calculations, studies showed that IMRs were very high.

1.1.2. The Works on Population Growth and Reducing Infant/Child Mortality

Some efforts have been made to increase population and decrease infant / child mortality with the acceleration of the recovery and development of the country in the early years of the Republic.

Turkish population policy was put into effect and started to be implemented. Population policy is composed of precautions related to population quantity and quality. There are two aspects of population policies that prohibitive and encouraging sides for population growth. Practices were made in the prohibitive direction such as prohibiting the importation of tools and equipment that provide miscarriage or preclusion of childbearing, criminalization of miscarriage, prohibition of publication of contraceptive information. The main incentive was to encourage births in rural areas (Kepenek & Yentürk, 2004). Although birth rates have been encouraged by incentive policies, high mortality rates were still evident. The reduction of death rates was the main problem of all underdeveloped countries. The establishment of the Ministry of Health is an indication that public health work was considered a state work. The health and aid policy of the Republic consisted of issues such as increasing births, decreasing deaths, protecting homeless against epidemics, patient beds and medicines for sick and poor citizens (Yellice, 2007: 51).

The state established the Central Statistical Department in order to carry out the population policy in a healthy way and to analyze the population while legislating for increasing population in 1926. After the 1927 census, the second census was made in 1935 and after the second census, the years ending with 0 and 5 were accepted as the general census year. In addition, the institution has supported policies aimed at increasing population through various publications. Thus, it was possible to perform population analysis of the period and a situation evaluation was made to reduce infant mortality.

Another work to decrease infant mortality was that Children’s Palace was established in Ankara. It has a feature of institution to provide classroom, library, cinema, clinic, pharmacy, laboratory and milk drop in bathroom in a land allocated by the Turkish Grand National Assembly (Malkoç, 2018: 42).

Himaye-i Etfal Association has an important place for prevention of the practical obstacle established by infant/child mortality against the population growth policies. Most homeless children left behind by the war was the main reason for the establishment of the institution. The purpose of the association was to protect children's life and law in 1928. It was structured to prevent miscarriage, death of infants and children, the bad manners to child and ensure robust

child upbringing (Albayrak, 1988: 32). Himaye-i Etfal Association was renamed as Turkey Child Protection Agency in 1934.

1.1.3. National Turkish Medical Congresses and Infant / Child Health

National Turkish Medical Congress (NTMC) was a fairly important place in both giving direction to health policy of Turkey and studies about reducing infant/child deaths. NTMC was organized because of health problems in the country, seeking a way to solve the infectious diseases, investigating, exchanging information, following developments in medicine both in our country and contemporary countries. Turkey Medical Council, the country's only medical society, arranged NTMC in the early years of Republic (Arıkan, 2005: 40).

The fact that child deaths are the main subject of NTMC in the first years of the Republic is affiliated to socioeconomic status of the country. In first years of the Republic, the health organization was insufficient. The number of physicians, health officers and midwives were insufficient. The number of hospitals, maternity houses and childcare centers were insufficient. Some of the people had malaria, tuberculosis, trachoma, syphilis. The congresses that started under these conditions and the physicians who organized these congresses, prepared the reports as one body who worked on this issue by choosing the subject of malaria, tuberculosis and child death from the most important health problems of the country. The information gathered by these reports was used by the governments, and the war against these diseases was initiated by the methods proposed in the areas where diseases spread (Arıkan, 2005: 237).

First NTMC was held in 1925 in "The Grand National Assembly of Turkey". In the first session of the congress, many issues have been emphasized on population politics, prevention of child mortality and public health. Besim Ömer Akalın and Refik Münir (Keskingil) suggested that preventing child deaths and increasing population are a matter of importance for every country before World War I and that Europeans have established many organizations to solve this problem in his papers entitled by "Child Losses Before and During Childbirth". They stated that there was no interference, no documentation to detect child deaths. Some of the children deaths exists before they are born and some of them die in childbirth. Precautions can prevent most deaths in pregnancy.

Asaf Dervish Pasha, mudarris and medical doctor, and Hamit Osman, medical doctor, mentioned in their papers titled by "Deaths in Infants" that acute infectious diseases, diphtheria, pertussis, scarlet fever and measles cause death of children, tuberculosis lead to a small number of deaths in infants, syphilis kills in 3 months, malaria causes death in such places as Adana and Mersin.

The following precautions have been proposed against child deaths in the Congress:

i. It should be ensured that births are notified to the population administrations;
ii. Training of statistical experts,
iii. Imposing a health tax such as tax on education for particularly child deaths and health expenses.
iv. Allocating some of revenues of municipal and private administration to health affairs.
v. Opening a branch office against child death in the Ministry of Health,
vi. Establishing children hospital, infant nursing home, maternal nursing home at Ministry of Health's command in one of major cities.
vii. Increasing of maternity in İstanbul,
viii. Training of midwives and nurses,
ix. Nursing as a profession and the right to retirement,
x. Establishing of combat societies with child deaths,
xi. Doctors should be subjected to courses for childcare.

In addition, the effect of breast milk on the development of the infant has been emphasized and the rate of breastfeeding is 95% (Arıkan, 2005). According to statistical data, half of the births were lost in the first two years. In 1926, tuberculosis vaccines from abroad were prepared and children were sent to pediatric clinics for oral administration. In 1927, close to 100 children were vaccinated in this way. In 1928, 50 more children were vaccinated (Özpekcan, 2002: 193).

The topics of struggle with epidemics such as trachoma, tuberculosis and syphilis were discussed in the congresses held in 1927 and 1929. Reducing epidemics is a crucial factor that reduce child mortality.

Economic crisis which affected the entire world has also affected Turkey in the early 1930-1939 period. The war with infectious diseases continued to be expanded to the extent allowed by the budget. Requirements were met by opening new treatment institutions and number of beds was increased (Arıkan, 2005: 237). During this period, nutrition studies were carried out in the city and in the village. Nutritional deficiency is a reason of the infant mortality.

The issues of nutrition in the city and the village and rickets were discussed in the congress held in 1931. In fact, rickets is caused by vitamin D and sunlight deficiency in children between 6 months and 2 years. This disease was prevented by vitamin D which was started immediately after birth (Arıkan, 2005: 40).

It was thought that giving importance to preventive medicine will be more beneficial in pre-or post-birth hygiene, vaccination and prevention of diseases in addition to discussions about eugenics in the congress held in 1938 (Arıkan, 2005: 65).

The period of 1940-1945 was the period when the developments of the economy, which had been positive since the beginning of the Republic, were interrupted. Basic programs have been tried to be continued although war economy has affected both the preventive medicine services and struggle against infectious diseases has been disrupted. Treatment services also affected in the environment of war, investments significantly decreased (Soyer, 2004: 48).

In the period 1946-1950, the transition from a single party to a multi-party period also influenced health politics. Implicit economic policies based on closed, protective external equilibrium, which were put into practice along with 1929 Great Depression, were abandoned in 1946, instead of policy that prioritizes industrialization, a development model focusing on agriculture, mining infrastructure investments and foreign markets has been preferred. The impact of this period is the National Health Plan. This plan, which is highly qualified study, has not been fully implemented and health centers have been generally opened in provinces.

In 1946, the selection of health and vitamin issues in villages at the 9th congress were due to "Village Midwifes and the Village Health Service Law" issued by ministry in 1943. It has been a useful step in terms of prevention of infant mortality and preventive medicine. Post-1945 treatment services began to revive, maternity hospitals were opened (Arıkan, 2005: 240).

The period of 1950-1960 is the years in which the government changed, and the economic recession was experienced after 1954. Socially, there has been a period in which industrial production has increased especially in the private sector, irregular urbanization and squatting have been experienced and the share of workers in irregular marginal jobs has gradually increased.

In the congress held in 1952, child health issues were discussed. Child health is a medical and social case. First, the child must come from the unification of a man and a woman which are physically and mentally healthy. The mother needs to undergo periodic examinations, receive education and give birth in a healthy environment during pregnancy. After the child is born, it should be provided to meet the needs of the physician, periodic care with the nurse, protection from the diseases and nutrition (Arıkan, 2005: 110).

The IMR reflects the level of development of countries at the world. IMR in Turkey over the years: 260 per thousand in 1945, 150 per thousand in the year 1965-70, 65 thousand in 1985-90, 37 per thousand in 1998, 32 per thousand in the 2000s. It also differs according to regions in our country. It was 43 per thousand in the west, 58 per thousand in the east. According to the services

provided to the mother, IMR was 29.6 per thousand in the number of prenatal care and childbirth services which were taken both; It was 50 per thousand in one of these services taken, and none of these services which is taken was 95 per thousand (Arıkan, 2005: 111). The Maternal and Child Health Organization was established within the Ministry of Health as reported at the 12th Congress held in 1952. While health care for children was initially perceived only as a treatment of diseases, advances in health science have revealed the fact that services to prevent and early recognition of diseases are easier and cheaper. The understanding of monitoring healthy children at certain intervals was founded by MCH centers in 1950. In this context, it was foreseen that the Maternal and Child Health Center will be for 30-50 thousand people, Maternal Child Health Branch for 10-30 thousand people, village stations will be established for 25-40 thousand people. The School Nutrition Project initiated in 1959. Milk powder and other nutritive foodstuffs were distributed together with "the Ministry of National Education". In the 1960s, Maternal and Child Health Centers, which were institutionalized under the law on the Socialization of Health Services, became widespread. In these years, 26 MCH centers and 19 MCH branches were opened (Soyer, 2004: 94).

In the congress of 1958, public health was taken into consideration. It is called the public health service, which belongs to all activities aimed at taking measures that will ensure an appropriate life level to ensure a healthy life and a longer life span, preventing disease, prolonging life, establishing necessary sanitations in order to increase physical and mental health and abilities of individuals, war against diseases in the social field, teaching hygiene rules to the person, early diagnosis of diseases and taking physician and nurse training to take preventive measures and treatment (Arıkan, 2005: 148). Public health services include studies of reducing IMR in terms of the concepts of sanitation and hygiene. The social problems that need to be addressed in reducing infant mortality throughout the country are:

i. Continuous preparations for combating disease,
ii. Establishment of preventive medicine facilities and organization within the scientific basis,
iii. To provide all kinds of health care services of pregnant, maternity and newborn and to ensure the continuity of their protection and care.

Health services were envisaged to be for preventive medicine in the new plans foreseen by the 1961 constitution, and "Law on the Socialization of Health Services" was enacted in 1961. However, the physician's relationship with the society and the state, the social status of the Turkish physician and the country's growing health problems were discussed in the last three congresses.

No solution could be reached, and the Ministry of Health has not shown the necessary importance. The socioeconomic crisis in which the country resides also delays solutions (Arıkan, 2005: 230).

In the 19th Congress in 1966, the issue of population planning and family planning was discussed. "Population Planning Law" was enacted in 1965. The rapid population growth worsened both social and security situation of the family and decreased per capita income. Children have not been to be nursed. For this reason, this law has been enacted so that families can have as many children as they can (Arıkan, 2005: 233). Following the emergence of the law, Directorate General of Population Planning was established. Directorate General of Population Planning was merged with "Maternal and Child Health Organization" in 1982 and it became "the General Directorate of Maternal and Child Health and Family Planning" (Arıkan, 2005: 112).

As a result, at the end of the War of Independence, the population was 12.5 million, 13.648.000 in 1927, 16.158.000 in 1935,18.780.000 in 1945, 24.065.000 in 1955, 31.391.000 in 1965. As seen, the annual increase in the first period was between 10-20 per thousand, but between 1955 and 1965 it increased to 25%. While 1930 General Hygiene Law was encouraged to increase the population, after that the term of contraception has emerged due to rapid increase (Ege, 1992: 36).

1.1.4. Infant Mortality Rates and Structural Changes After 1960

High IMRs have been observed in Turkey according to its economic level. The 1960s can be a turning point in this sense. From the 1960s onwards, Five-Year Development Plans were initiated. The first of these plans was put into practice in 1963. The main objective of this application is to replace unplanned and uncontrolled growth and development in the 1950s. These development plans also cover the field of health and have some goals on the reduction of infant mortality. IMR in Turkey remained high until the mid-2000s by the economic level. IMR was 150 ‰ in the mid-1960s; 110 ‰ in the 1970s, 73 ‰ in the 1980s. It decreased to 44 ‰ in 1990s. In the 2000s, IMR began to decrease more rapidly. It has fallen to 10 ‰ in 2017 (The World Bank, 2019i)

Behind this remarkable decrease in response to the socioeconomic changes was Turkey's important share of intensively applying maternal and child health programs since the 1980s.

Table 1: NMR, PMR, IMR in Turkey

	NMR (‰)	PMR (‰)	IMR (‰)
TDHS-1978	60	74	134
TDHS-1983	42	58	100
TDHS-1988	35	47	82
TDHS-1993	29	23	52
TDHS-1998	26	17	43
TDHS-2003	17	12	29
TDHS-2008	13	4	17
TDHS-2013	7	6	13

Source: TDHS 1978-2013

Between 1978 and 2013, 90% decrease in IMRs was calculated by considering Turkey Demographic and Health Survey (TDHS) data.

Table 2: Percentage of Deaths in Infant and Neonatal Period

	Mortality in Infant Period		Mortality in Neonatal Period	
	Distribution of Neonatal Period (%)	Distribution of Postneonatal Period (%)	Distribution of Early Neonatal Period (%)	Distribution of Late Neonatal Period (%)
TDHS-1978	44.8	55.2	68.0	32.0
TDHS-1983	42.0	58.0	69.0	31.0
TDHS-1988	42.7	57.3	70.0	30.0
TDHS-1993	55.7	44.3	74.0	26.0
TDHS-1998	60.5	39.5	72.0	28.0
TDHS-2003	58.6	41.4	73.0	27.0
TDHS-2008	76.5	23.5	87.0	17.0
TDHS-2013	53.8	46.2	80.8	19.2

Source: TDHS 1978-2013

As seen in the Table 1 and Table 2, there are also changes in the timing of death of deaths with decreasing infant mortality. In the period 1978-1988, the deaths of postneonatal deaths were higher in infant deaths. However, the weight of neonatal deaths started to be higher in 1993. Neonatal deaths are mostly related to pregnancy and birth but postneonatal deaths are more affected by environmental, socio-economic factors. Environmental factors, which are effective in diseases preventable by vaccination, respiratory tract infections and diarrhea, are more

determinant in deaths occurring in the postneonatal period. These deaths can be prevented by low-budget medical (health) investments and by improving socio-economic conditions. Preventing deaths in the neonatal period requires more costly medical investments (Koç & Eryurt, 2011: 41).

IMRs were measured in a study covering the years 1967-1988 in Etimesgut Health Education Research Area. It was found that the decrease by 79.7%, 62.7%, 85.5% respectively in IMR, NMR and PMR. The most significant reduction in NMRs was 84.7% in late NMR. The causes of infant mortality are different for 1967 and 1988. In 1967, the first three causes of death were pneumonia (49.3%), diarrhea (15.2%) and perinatal causes (10.6%). In 1988, congenital malformations (17.8%), perinatal causes (16.7) and pneumonia (13.1%) were seen respectively. While the share of pneumonia in infant deaths decreased considerably, the share of congenital malformations and perinatal causes increased. The causes of infant death in 1967 (pneumonia and diarrhea) are among the most common causes of postneonatal death, while the causes of infant death in 1988 (congenital malformations and perinatal causes) are mostly caused by neonatal death. Etimesgut, the district in the capital, realized the structural change in the cause of infant deaths can be said of Turkey's overall average realized before. In addition, in a study carried out according to autopsy results of 862 infants who died during infancy (neonatal) in Hacettepe Children's Hospital between 1977-1987, it was reported that infectious diseases were ranked first with 33.60 per thousand (Altınkaynak, Yaman, & Handan, 1991). Infectious diseases are known to be among the causes of postneonatal infant mortality.

Turkey in the 1978-2013 period, consistently shows that early neonatal deaths is now proportionally more of late neonatal deaths as seen from the Table 2. In 1978, 68% of neonatal deaths occurred in early neonatal period. This distribution rate increased over time to 74% in 1993. Finally, it increased to 81% in 2013.

The transformation in the structure of IMRs can be attributed to the work in preparation for comprehensive health reforms covering the entire health sector, where health reform efforts accelerated towards the end of the 1980s. In 1988, the financing structure of the health sector was examined with the experts of the World Bank. In 1990, "The Health Sector Master Plan Study" was carried out by "the State Planning Organization". First Health Project in 1990, Second Health Project in 1994 and Primary Health Care Project were started in 1997. In 1992, a green card was introduced. The Green Card application provided the public with free health care services for the low-income groups who do not have the power to provide health services (Yıldırım, 2013).

High-budget investments are needed to reduce neonatal infant mortality. Therefore, the places where neonatal infant deaths decrease are in developed countries and regions. Reduction in postneonatal infant mortality can be achieved through low-budget investments. Therefore,

postneonatal infant mortality is seen to decrease in developing and less developed countries and regions. The application of green card has been of great benefit for those who cannot benefit from health services and therefore have a high risk of postneonatal infant mortality. In addition, it is thought that the application of green card causes change in the structure of IMRs.

The fact that IMRs can be withdrawn to level of countries in upper income group necessitates the reduction of neonatal deaths. It is necessary to reach risk groups, to improve health infrastructure with cost-intensive investments and to improve service quality in order to attract neonatal deaths to lower levels. Neonatal mortality is more affected by precautions associated with health such as pre-natal mothers care and post-natal infant care (Koç & Eryurt, 2011).

1.2. THE RELATIONSHIP OF INFANT MORTALITY RATE WITH DEVELOPMENT GOALS

Infant mortality is a problem of medical and health sector, but IMR is an indicator of the level of development of countries at the global level. While the physical growth of countries (gross domestic product increases, price stabilization, low unemployment) is of great importance from the economic view, development refers to the quality of a country's growth.

Recent global development discussions at global level are based on sustainable development. Following the “United Nations (UN) Conference on Environment and Development in Rio de Janeiro in 1992”, “the Millennium Summit in 2000” and “the Sustainable Development Summit in 2012” became two important milestones for the global development agenda. While MDGs are intended to act only in developing countries, the SDGs are universally adopted in all countries. In addition, another key feature of the SDGs is the concentration on implementation tools (financial resources, capacity development and technology) (Escarus, 2017: 18).

MDGs were formed in 2000, measured by 60 indicators, including 8 targets and 21 sub-targets for a period of 15 years, with the participation of 191 member countries and at least 22 international organizations. The eight main objectives are as follows (The United Nations, 2015);

i. “Eradicate extreme poverty and hunger”
ii. “Achieve universal primary education”
iii. “Promote gender quality and empower women”
iv. “Reduce child mortality”
v. “Improve maternal health”
vi. “Combat HIV/AIDS, malaria and other diseases”

vii. “Ensure environmental sustainability”

viii. “Develop a global partnership for development”

Although the fourth of these goals is directly related to infant mortality, goals such as improving the maternal health at the fifth goal and combating diseases at the sixth goal affect the infant mortality indirectly. From this point of view, the fact that it is taken as a whole rather than looking at the goals one by one is the basis for achieving the goals. The objectives are complementary. While the development models that do not address the economy, environment and social development with a holistic approach, they endanger the capacity to fulfill the demands of future generations.

MDGs are achieved goals related to infant and child mortality in Turkey. “The fourth goal aims to reduce by two thirds under five mortality rates between 1990 and 2015” (The United Nations, 2015: 32). The U5MR was 74 per thousand in 1990 and 13.4 per thousand in 2015. U5MR decreased by 81.89%. At the same time, IMR was 55.4 per thousand in 1990 and it was 11.6 per thousand in 2015. IMRs decreased by 79.06% (The World Bank, 2019). MDGs have been achieved both in U5MR and IMR.

“The fifth goal of the MDGs is to reduce maternal mortality by three quarters between 1990 and 2015 in the field of improving maternal health” (The United Nations, 2015: 38). The most effective factor in maternal deaths occurring during labor and delivery is related to the presence of qualified personnel at birth. The maternal mortality ratio in Turkey has dropped from 97 per hundred thousand live births in 1990 to16 per hundred thousand live births in 2015. 83.51% decrease was achieved in the period mentioned (The World Bank, 2019b). The main reason behind this decline is better quality health service offered in the prenatal and postnatal period, and a decrease in birth rate during the adolescence period. It is said that the problem continued in the less developed regions and rural areas in Turkey (Bayazıt & Önsal, 2017: 11).

Combating against the epidemic diseases in Turkey has made progress, except for cases of HIV infection. While the number of HIV infections is 41 in 2002, it has risen to 119 in 2015. The incidence of the disease increased from 0.06 per a hundred thousand people in 2002 to 0.15 in 2015. In 2002, malaria cases were reduced from 15.4 per a hundred thousand people to 0.3 per year in 2015. Tuberculosis cases were 32 per a hundred thousand in 2002 to 15.9 in 2015 (The Republic of Turkey Ministry of Health, 2018: 35).

It is said that in many areas of overlap with MDG priorities from the experience of Turkey in the MDG. However, while achievements in poverty reduction, education, women's empowerment and climate change remain limited; prevention of absolute poverty, the reduction in inequality of

enrollment among genders, the reduction of infant and maternal mortality rate, access to water increased or global cooperation has made an important achievement when compared with the world in Turkey (Bayazıt & Önsal, 2017: 15).

The 2012 Sustainable Development Conference aims to bring all previous efforts to a more integrated and inclusive global development agenda. The development agenda, called the 2030 Development Agenda, was adopted in 2015 in New York. 2030 Development Agenda covering 17 targets and 169 goals, has been implemented worldwide since the beginning of 2016. The agenda includes numerical and qualitative goals to be reached by 2030 and is a holistic guide to guide policies and practices for all countries (Bayazıt & Önsal, 2017: 4).

Although the SDGs are not legally restricting, governments are expected to indicate ownership and national frameworks to achieve the 17 goals. The primary responsibility for monitoring and reviewing progress made in the implementation of SDGs is the country's responsibility. Regional monitoring and review will be conducted based on national-level analysis, which will contribute to monitoring and review at the global level (Escarus, 2017: 19).

The national priorities of countries should be combined with these goals and monitored and evaluated in four-year terms within the framework of the post-2015 development framework, . During this period, SDG with issues of high importance for Turkey took place during the first period when Turkey re-evaluated in line with national policy. SDGs which is compatible with Turkey's priority goals for the first period are, respectively, “affordable and clean energy (SDG 7), quality education (SDG 4), wastewater and clean drinking water (SDG 6), peace and justice (SDG 17) is determined. For the second period, health (SDG 3)” is the most important goal. The goal of health and welfare is divided into 9 sub-targets. SDG 3 has four main themes to provide a healthy life at all ages and to promote well-being. These are health programs, preventive programs, health resource usage and environmental health (Bayazıt & Önsal, 2017).

A large number of projects have been carried out by the Ministry of Health for the purposes of SDG 3 and some of which have been supported by WHO, UNDP and the World Bank, and most of these projects have been integrated into general structuring and routine programs over time. Social Security Reform and Family Medicine practices implemented within the scope of Health Transformation are among the most fundamental reforms. In addition, the Community Health Centers, which are the centers where primary health care services are provided and coordinated within the scope of Family Medicine practice, come to the fore as the practices in this field. In addition, semi-public organizations and non-governmental organizations also carry out projects on issues such as maternal and child health, reduction of infant mortality, prevention of substance addiction, prevention of traffic accidents, and awareness of healthy living (Escarus, 2017: 59).

The sub-goal of SDG 3.2 is “to end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births by 2030”. SDG 3.2 is determined to be invalid target for Turkey. If the goal is exceeded by Turkey or the scope of goal cover a country group that does not include Turkey (low development countries etc.), goal is judged to be invalid target for Turkey. In 2016, the IMR in Turkey is 6.2 per 1,000 live births; U5MR is 11.9 per thousand. Both rates were exceeded because they were below the 2030 goals. The goals were stated to be invalid (Escarus, 2017: 31). Globally, the IMR has reached the goal position even though Turkey has highest IMRs among OECD countries. Thus, infant mortality is still an issue that needs to be addressed on a risk indicator for Turkey.

Turkey's sustainable development objectives within the scope of the current state of health and welfare appear to be the target of development and improvement. Turkey is quite ahead of the global target and average, including infectious diseases and maternal and infant mortality. It is expected that recovery targets will continue, especially in terms of the elimination of regional differences in line with the objectives of the national strategy plans. As a developing country, Turkey must be subjected to a comparison in their classification.

The World Bank classifies the countries according to by region, by income and by operational lending. Turkey is one of countries in Europe and Central Asia by region. It is upper middle-income country by income. Besides, it is one of the countries “International Bank for Reconstruction and Development (IBRD)” countries by operational lending (The World Bank, 2019j).

“There are 58 countries in Europe and Central Asia. The World Bank has classified this country group into two separate categories: Europe & Central Asia (excluding high income) and total (Europe & Central Asia)”. Excluding the high-income countries, the IMR for 2017 in Europe and Central Asia is 11.43 per thousand. The IMR, including high income countries, is 7.7 per thousand in 2017. The IMR is 10 per thousand in Turkey. Turkey is above average among European and Central Asian group of countries and Turkey has higher IMR (The World Bank, 2019f).

When the classification is made according to national income per capita of the countries. “Turkey located in the upper middle-income group with 56 countries. Countries in the upper middle-income group include countries with a per capita income of $ 3,896 to $ 12,055” (The World Bank, 2019j). The IMR in this group is 11.6 per thousand in 2017. The IMR in Turkey is lower than the that of upper middle-income countries in 2017 (The World Bank, 2019d).

“Economies are divided into three categories as IDA (The International Development Association), IBRD (International Bank for Reconstruction and Development) and Blend countries according to the World Bank's operational policies”. IDA is composed of countries with low per capita incomes without financial adequacy for borrowing from IBRD. Blending countries are eligible for IDA loans, but are also eligible for IBRD loans because they have financial credibility (The World Bank, 2019a). Within this framework, Turkey is entering the IBRD group. IBRD consists of 69 countries. In 2017, the IMR for IBRD was 20.25 per thousand. Turkey has a much lower IMR in this group of countries (The World Bank, 2019e).

“The Organization for Economic Co-operation and Development (OECD) is an international economic organization founded in 1960 with the aim of strengthening economic development and world trade, and with the participation of Lithuania in July 2018, with 36 member states” (OECD, 2019). The IMR of OECD countries in 2017 was 5.70 per thousand. Turkey, as a member of the OECD, has the second highest IMR which is 10 per thousand in the member states. Mexico has the highest IMR which is 11.5 per thousand in OECD (The World Bank, 2019h).

Turkey has a better average in IMR than the country groups which does not include all of Europe such as IBRD and upper middle-income groups. In classifications including the whole of Europe (OECD countries, Europe and Central Asia countries), Turkey is worse than average. As a result, Turkey's potential and location should be required to reduce the IMR for being in the level of development of European countries.

CHAPTER 2

LITERATURE REVIEW

Many global and local studies have been conducted on IMRs and determinants. Even though not all of these studies have the same variables, there are also some common indicators. In this section, the factors affecting IMRs and child health will be specified and the IMR will be examined by differentiating three categories according to the development levels of the countries: developed countries, developing and less developed countries and Turkey.

2.1. MAIN FACTORS AFFECTING INFANT MORTALITY

Rodgers (1979) states that external factors such as education, clean water, good nutrition, health services, medical and technological developments affect health status, but empirically it is very difficult to differentiate these effects because many of these variables change and interact with each other. These factors are maternal factors (maternal age, birh interval, malnutrition and breastfeeding), birth factors and diseases (low birth weight (LBW), premature, congenital malformations, sudden infant death syndrome (SIDS), infectious diseases), demographic factors (race/ethnicity/gender, traditions/norms/attitudes), economic factors (income and inequality of income), access to healthcare, education, air pollution and public policy.

2.1.1. Maternal Factors

2.1.1.1. Maternal Age

Maternal age at birth is thought to be one of the factors affecting infant mortality. There is a U-shaped (curvilinear) relation between the risk of infant mortality and maternal age. It is stated that mothers who give birth in young and late ages have a high risk of infant mortality compared to other age groups (Geronimus, 1986; Maitra, 2004; Bhalotra & Van Soest, 2008). The leading causes of infant deaths among adolescent mothers are pregnancy and birth complications. “Women who give birth before the age of 20 have a higher risk of infant mortality than women who give birth at the age of 25-29” (Seckin, 2009). According to another study, adolescent mothers and mothers older than age of 40 have double high risk of infant mortality (Andrews,

Brouillette, & Brouillette, 2008: 357). LBWs, preterm births and severe neonatal conditions carry the risk of births for mothers under 20 years of age in low- and middle-income countries (Ganchimeg et al., 2014). Maternal risk factors are the cause of neonatal mortality. There are also studies stating that motherhood at a young age is an explanatory variable for infant mortality. (See for example, Kozuki et al. (2013), Olausson, Cnattingius, & Haglund (1999))

2.1.1.2. Birth Interval

There is not definite relation between birth intervals and infant deaths. The chances of survival of the infant decrease as the birth interval decreases. The short birth interval is caused by maternal depletion. Close-range births do not give the time to provide the mother's psychological and nutritional need for pregnancy (Koenig, Phillips, Campbell, & D'Souza, 1990). Fast repetitive pregnancy offers more risk factors for both mothers and children, especially for young mothers (Kozuki et al., 2013: 3).

In another study, it was stated that the relation between the previous birth interval and infant death may not be true. The reason for this is that in women who tend to breastfeed for a shorter time, the duration of the lactation will decrease the time to suppress the fertility and cause a short birth interval. Short-term breastfeeding children are probably to die. Therefore, the short birth interval may not be the cause of infant death (Pebley & Stupp, 1987).

In a study using Peru data, it was observed that the effects of birth interval were visible three months after the birth of the infant and the effect was stronger when the family's resources were limited. The high risk of death in short birth intervals shows itself until children are two years old (Palloni & Tienda, 1986).

2.1.1.3. Malnutrition and Breastfeeding

"Malnutrition refers to deficiencies in a person's nutritional or energy intake, redundancies or imbalances. Malnutrition covers two broad conditions. One of these is the lack of micronutrient deficiencies (deficiency of vitamins and minerals) with undernutrition which causes stunting (low height for age), wasting (low weight for height), underweight (low weight for age). The other one is overweight, obesity, and diet-related non-communicable diseases (heart disease, stroke, diabetes and cancer). Undernutrition is associated with 45% of child deaths". In 2016, it was estimated that "155 million children under the age of 5 were stunted, 52 million were wasted, and 41 million were overweight or obese" (The World Health Organization, 2016c).

Malnutrition has a negative effect on combating infectious diseases. In many studies, infectious diseases, malnutrition, which constitute 45-57% of infant deaths in Ethiopia, Malawi, Guatemala and India, have been found to be potential. The importance of breastfeeding in reducing malnutrition is important. Some cultural tradition in developing countries, especially India, cause breaking breastfeeding instantly after birth. Therefore, infants who do not get the necessary micronutrients are faced with malnutrition and increase the risk of infectious diseases (Pelletier, Frongillo Jr, Schroeder, & Habicht, 1994). Jatrana & others (1999) stated that colostrum is the most prominent factor affecting infant mortality in Mewat, the least developed region of India.

"Infants should be breastfed for the first six months after birth in order to prevent severe acute malnutrition" (The World Health Organization, 2019). Breast milk fully meets the high-energy fat, vitamins, minerals and iron needed by the infant. It also prevents the growth of bacteria since breast milk is clean and hygienic, and substances contained in breast milk (Palloni & Tienda, 1986). It was stated that breastfeeding should be continued for longer periods in areas where there is insufficient water and sanitation (DaVanzo & Habicht, 1986). It also has the advantages of preventing allergy and obesity. Breastfeeding protects the infant against food and water containing harmful bacteria (Palloni & Tienda, 1986). "Breastfeeding enables the mother to devote the energy for feeding and caring for the infant instead of fertility. Longer breastfeeding times also contribute to the health of mothers: reduce the risk of ovarian and breast cancer and help to increase the time between pregnancies". Continuous breastfeeding of infants under 6 months of age usually results in a hormonal effect which causes menstrual failure. This is a natural contraceptive method known as the Lactation Amenorrhea Method (The World Health Organization, 2018c).

Infant mortality was found to be significantly reduced in infants who were regularly breastfed in 0–3 months in Latin America (Betrán, de Onis, Lauer, & Villar, 2001). In another study, it was stated that breast milk plays an important role in reducing neonatal mortality (Huffman, Zehner, & Victora, 2001).

2.1.2. Birth Factors and Diseases

2.1.2.1. Low Birth Weight and Premature Births

LBW is defined for infants weighing between 2500 gram and below and is an prominent risk factor for infant mortality. In the neonatal period, 60% -80% of deaths occur in infants with LBW (Andrews et al., 2008: 347). It is likely that normal weight infants will die in infancy at one of

five hundred probability. In contrast, for infants born between 1.5 and 2.5 kilograms, the IMR is 15 per thousand. Infants born under 1.5 kilograms are probably die. Infants born under 500 grams rarely survive (Andrews et al., 2008: 355).

99% of LBW is seen in underdeveloped and developing countries of Africa, Asia, Central and South America. In pregnancies with less than 24 months between two births, the lack of adequate postpartum recovery may lead to LBW. “Risk factors for low birth weight are preterm birth, poor maternal nutritional status, lack of antenatal care, and maternal sickness during pregnancy, and an unhygienic home environment” (Andrews et al., 2008: 347).

With the development of neonatal intensive care units (NICUs) in the 1960s, the probability of survival of sick infants increased. In particular, “the use of mechanical ventilation, parenteral nutrition and the use of surfactant for respiratory distress syndrome of the premature has progressed in the prevention of infant mortality” (Andrews et al., 2008: 357).

“Preterm is defined as infants born alive before the 37th gestational week is completed. According to the age of pregnancy there are sub-categories of premature birth. These categories are extremely preterm (less than 28 weeks), very preterm (28 to 32 weeks), moderate to late preterm (32 to 37 weeks). An estimated fifteen million infants are born very early each year. This is more than one in ten infants. Preterm birth complications are the leading cause of death among children under five years of age and are responsible for approximately one million deaths in 2015”. Approximately 947,000 newborn infants die from preterm birth each year in the first four weeks of delivery (The World Health Organization, 2018f).

“In low-income countries, half of infants born at 32 weeks (2 months early) die due to lack of care such as temperature, breastfeeding support, infections and basic care for respiratory distress. In high-income countries, almost all of these infants survive. Inadequate use of technology in middle-income countries leads to increased disability among neonatal surviving preterm infants”. Preterm birth can be prevented by providing antibiotics used to provide prenatal steroid injections given to women who are at risk of premature birth and for the treatment of neonatal infections. For example, it was stated that the continuity of care under the leadership of midwifery reduced the risk of prematurity by 24% (The World Health Organization, 2018f).

Premature and LBW are generally the causes of infant mortality for both the neonatal and postneonatal period but are considered to be mostly the cause of neonatal mortality. In a study conducted in Nigeria, it is stated that neonatal deaths are most frequently related to LBW and related complications (Lawoyin, 2001). In another study, the effect of LBW on postneonatal deaths was found to be significant (Abraham, D’Espaignet, & Stevenson, 1995).

The average premature birth rate in the world is 10% in 2014. the rate is 8.72% in Europe, 11.97% in sub-Saharan countries, 12.41% in Turkey (The World Health Organization, 2014). Premature birth deaths are more common in Aegean, East Marmara and West Marmara subregions (Dilli et al., 2016). The risk of neonatal death is thirteen times higher in premature children than full term[1] infants (Yasmin, Osrin, Paul, & Costello, 2001).

2.1.2.2. Congenital Malformations

Congenital malformations are defined as "structural or functional anomalies (e.g. metabolic disorders) that occur during intra-uterine life and which can be detected before, during or after birth". Approximately 303,000 newborn infants die in the first four weeks of birth in the world each year due to congenital disorders. These disorders cause long term disability. "The most common congenital disorders are hearth defects, neural tube defects, and Down's syndrome". Genetic, infectious, nutritional or environmental factors may cause, but the exact causes are difficult to determine (The World Health Organization, 2016a).

One of the antenatal care techniques for the prevention of genetic anomalies is to supplement the mother with folic acid which is taken during period of periconception decreases neural tube defects. According to the results of the national survey, neural tube defect rate is 4.3 and 4.9 per thousand births respectively in Northern Anatolia and Eastern Anatolia. It is about 3 per thousand in Turkey (Tekkesin & Taser, 2012).

Maternal age is a risk factor for abnormal intra-uterine development. Advanced maternal age increases the risk of chromosomal abnormality that causes Down's syndrome. Environmental factors may also be a cause for congenital disorders. In addition to "exposure to certain pesticides and other chemicals, exposure to certain drugs, alcohol, tobacco and radiation during pregnancy may increase the risk of a fetus or newborn affected by congenital anomalies" (The World Health Organization, 2016a).

Low income is an indirect reason for congenital anomalies, even if there is no direct cause. "Approximately 94% of the congenital anomalies happen in low- and middle-income countries. The rate of congenital malformations in infant deaths decreased by 18% between 1994 and 2002 in industrialized countries" (Andrews et al., 2008: 357)

[1] "Babies born before 37 weeks are preterm. Babies born between weeks 37 and 39 are considered early term while those born between weeks 39 and 41 are considered full term. Babies born between weeks 41 and 42 are considered late term while after 42. week they are considered post term".

The rate of congenital malformations in infant deaths in Turkey decreased to 10.3% in 2012, while 17.2% in 2007. Education of the population and prevention of consanguineous marriages prevent the formation of congenital anomalies (Dilli et al., 2016).

2.1.2.3. Sudden Infant Death Syndrome (SIDS)

SIDS identifies “sudden death in infants under one year of age”. Clinical history studies, autopsies and research on this subject could not explain why sudden infant death was caused. SIDS is a reason of postneonatal infant death. In the late 1980s and late 1990s, most countries organized "Back to Sleep" campaign, drawing attention to the importance of laying babies on their back. These campaigns encouraged the use of safe cradles and hard beds, the bed not being equipped with other items, and the prevention of smoking before birth. “In the US, the SIDS rate has decreased from 1.2 per a thousand live births to 0.35 per a thousand live births. Similar reductions were occurred in other countries worldwide when safe sleeping campaigns were initiated” (Andrews et al., 2008: 358).

Markowitz (2008) states that the connection between SIDS and smoking is strong. Not only in the postnatal period but also in the prenatal period, smoking can lead to SIDS, and therefore, any study on the reduction of smoking is expected to reduce infant mortality. In the study, “the taxation of cigarettes and the restrictions on smoking in public places are a prominent factor in decreasing infant mortality rate”.

2.1.2.4. Infectious Diseases

The WHO estimates that “seven in ten of child mortality is caused by acute respiratory infections, diarrhea, measles, malaria, and / or malnutrition”. Approximately 30% of deaths below five years of age are associated with acute lower respiratory infections and sepsis (Andrews et al., 2008: 348).

Pneumonia is the largest infectious disease that causes death of children worldwide. In 2015, pneumonia accounted for 16% of children under five years of age. While most healthy children can struggle with their natural defenses by infection, children with immunodeficiency are at higher risk of pneumonia. The child's immune system may be weakened, especially only in malnourished infants. “Pneumonia is most common in South Asia and Sub-Saharan Africa. It can be prevented by simple interventions and can be treated with low-cost, low-tech drugs and care”.

It can usually be treated without access to the hospital when there is access to antibiotics. Developing countries have 95% of pneumonia cases (WHO, 2016b).

Diarrhea is the second largest child death in the world. 17% of under five years of age deaths and 3% of neonatal infant deaths are caused by diarrhea. In under five years old children, malnutrition is the major cause of diarrhea. The prevention and treatment of diarrhea and dehydration are simple and low-cost with public health practices. A large proportion of diarrheal diseases can be prevented with clean drinking water, adequate sanitation and hygiene. “Every year, diarrhea causes the death of 525,000 children under five years of age. Better water, sanitation and hygiene can prevent the death of 361 000 children under five years of age each year” (WHO, 2018g).

Malaria is the cause of 11% of mortality below the age of five years. “In countries with endemic malaria, women tend to become infected by parasites during pregnancy. Perinatal malaria increases the likelihood of LBW, miscarriage and stillbirth” (Andrews et al., 2008: 349).

Measles are the fifth major cause of death in infants and children in developing countries. Measles-induced mortality is associated with complications such as pneumonia and diarrhea. “Treatment of measure includes administration of pneumonia and other infections, rehydration and vitamin A supplementation”. Although it was a safe and inexpensive vaccine, in 2017, Under five years old children suffered from the death of 110,000 measles. Measles vaccination caused a 80% decrease in measles death between 2000 and 2017. In 2017, approximately 85% of children in the world received a dose of measles vaccination through routine health care on their first birthday. In 2000, this rate was 72%. Approximately 8.1 million of the 20.8 million infants who were not vaccinated with at least one dose of measles vaccination by routine immunization in 2017 are from India, Nigeria and Pakistan. “Measles is still common in developing countries, particularly in Africa and some parts of Asia. The majority of measles deaths (over 95%) occur in countries with low per capita income and poor health infrastructure” (WHO, 2018d).

In the first 28 days of life, tetanus is called on neonatal tetanus. Neonatal tetanus constitutes 7% of all neonatal mortality. “Neonatal tetanus occurs when non-sterile instruments are used to cut the umbilical cord or when contaminated material is used to cover the umbilical cord. Deliveries made by people with unclean hands or a dirty surface are also risk factors”. Neonatal tetanus can be prevented by vaccinate the mother during pregnancy or before pregnancy. The compulsory DPT (diphtheria, polio, tetanus) immunization in India since 1981 has reduced the rate of neonatal mortality from 110 per thousand in 1997 to 71 per thousand in 1997 (Andrews et al., 2008: 349).

The compulsory DPT immunization has reduced the rate of neonatal mortality from 110 per thousand in 1997 to 71 per thousand in 1997 in India. In 2017, 85% of the infants (116.2 million

infants) worldwide were vaccinated with three doses of diphtheria-tetanus-pertussis (DTP) containing vaccine. “In 2017, 123 countries have at least 90% of the DTP3 vaccine. 19.9 million infants worldwide have not been reached to immunization services such as 3-dose DTP vaccines”. “Approximately 60% of these children live in Afghanistan, Angola, Democratic Republic of Congo, Ethiopia, India, Indonesia, Iraq, Nigeria, Pakistan and South Africa” (The World Health Organization, 2018b).

“Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection”. It is estimated that 3 million newborns and 1.2 million children have sepsis every year. Approximately 401,000 newborn babies die each year from neonatal sepsis in the first four weeks of delivery (The World Health Organization, 2016a).

2.1.3. Demographic Factors

2.1.3.1. Race/Ethnicity/Gender

In the United States, IMRs vary according to race / ethicity. African and Indian American mothers have more IMRs than others. LBW rates are higher among African people than mainly Caucasians and Hispanic. The IMR in African people is 2.4 times higher than the IMR in Caucasians (Andrews et al., 2008: 357). When the factors other than the biological effects in the determination of gender are examined, economic efficiency can be shown as a factor affecting infant survival rates. In a study conducted in India, a 37% increase in female employment rate, when taken as a variable for women's contribution to the economy, would eliminate the difference in survival between the genders. As a result, the increase in income level is stated as a factor that increases the survival rate of girls compared to boys (Rosenzweig & Schultz, 1982).

2.1.3.2. Traditions/Norms/Attitutes

People's behavior and attitudes can change according to the society they live in. The cultural determinants of infant health are important at this point. In traditional societies, the mother is responsible for taking care of the newborn infant and meeting the needs of the infant. Therefore, mother's education is of greater importance in traditional societies, and it may be to the benefit of the mother to shift the power relations to the mother. Besides, the value of the girl varies in traditional societies due to factors such as brideprice and female dowry. For example, IMR is lower in girls which be valued to taking brideprice in Kenya. In traditional societies, due to high

population, policies reducing the number of households, intentional injury (infanticide) can be done and female infant mortality is higher than male infant mortality. (See for example Caldwell (1979); Safilios-Rothschild (1980); Scrimshaw (1978))

2.1.4. Economic Factors

2.1.4.1. Income

In countries with high per capita income, there is access to better education and health services. Therefore, health literacy rates are higher. There is also researcher who have no direct link between income and health. “The impact of income on infant health can be through food consumption, housing, sanitation, health care and education. Improvement in nutrition, which is one of the most important explanatory variables for decreasing IMR, is associated with increased income” (Wolpin, 1997). Alves & Belluzzo (2004), Hakobyan, Mkrtchyan, & Yepiskoposyan (2006) and Renton, Wall, & Lintott (2012) stated that per capita income is the most important factor in decreasing infant mortality.

Some studies have analyzed the effect of income on IMRs during economic crisis. (Cruces, Glüzmann, & Calva, 2012) stated that IMRs have increased in 2001-2002 Argentine economic crisis. In a study examining the effects of the 1988-1992 Peruvian economic crisis on infant mortality and child health, it was found that the IMR was 50% higher in crisis years than before and after the crisis. Economic crises have two important effects on IMR. The first one is the deterioration in the living conditions (nutrition, education, hygiene, maternal education etc.) and the second one is the decrease in public health expenditures (Paxson & Schady, 2005). In contrast, Kunitz, Simić, & Odoroff (1987) stated that the economic crisis that started in Yugoslavia in 1979 did not have a great impact on IMRs. It is stated that the effect seen in poor families is less.

Some studies signify that the effect of income on decreasing IMRs is not as high as expected and other factors are more effective.

Burgess, Propper, & Rigg (2004) conducted a study in England on low-income families and the direct effect of income on child health was found to be low. In the same study, a strong relationship was found between the mother's past life (diet, living conditions, early employment, past experiences, etc.), behavior and health, and child health.

Tüylüoğlu & Tekin (2009) examined the effects of IMRs of 176 countries in 2003 by multiple regression analysis. It is stated that health expenditures have more significant effects on IMRs

than per capita income factor. The introduction of basic health services (such as mother-child health programs, immunization) has an impact on IMRs. Providing health expenditures to people who have not income through social government practices makes the impact of health expenditures more explanatory.

Mosk & Johansson (1986) stated that the delivery of drugs and health services to the poorest residential areas would be more effective than the effect of income on mortality rates. It is said that technological developments related to health and the application of these developments are more effective than income effect.

Although income is important, there are countries with good health outcomes even though their income is not very high. A poor country can achieve a relatively low IMR through policies that collectively address education, nutrition and basic maternal and infant health services. According to Andrews et al. (2008), "the per capita gross national income in Niger was 230 dollars and the IMR was 152 per thousand. Less than 5% of women in Niger use modern contraception. Total adult literacy is about 14%. On the other hand, the national income per capita in Vietnam is 550 dollars and the IMR is 17 per thousand. State-funded health care programs allow 90% of mothers to be vaccinated for tetanus and 85% of mothers receive antenatal care and medical birth benefits. At the same time, Vietnam's literacy rate is around 90%. The difference between the two countries in the gross national product is $ 300. The reason why IMRs remain very low in Vietnam compared to Niger is attributed to factors such as literacy and national health programs".

For Nigeria, random effect and fixed effect methodology was used in the study which examined the relationship between household income and neonatal, infant and under-five child deaths. In addition to household income, access to safe water and sanitation, access to anti-natal care, maternal education and households are also included in the model. As a result, it was stated that household income had an effect on NMRs but had no effect on IMRs and child deaths under five years of age. It was also said that household size had a significant impact on NMR and IMR. It has a significant effect on anti-natal care for only under five years old children (Edeme, Innocent, & Okereke, 2014).

2.1.4.2. Inequality of Income

Inequality in income distribution also affects infant mortality. Countries with a fair income distribution have a lower IMR than countries with a poor income distribution for in groups of countries with similar per capita income. "Infant deaths are more common among poor people because infants and children are vulnerable to poor living conditions. The increase in income

inequality causes the relative situation of poor people not to improve and increase infant mortality" (Flegg, 1982; Waldmann, 1992; Wennemo, 1993).

2.1.5. Access to Healthcare

Access to health care is a prominent health factor variable in preventing infant mortality. Liebert & Mäder (2017) examined the relationship between physician coverage and infant mortality by taking the process between 1927-1936 in Germany. It is stated that today's developing countries and comparatively developed countries a century ago have almost the same supply density, which is comparable to infant mortality and coverage ratios. The rate of increasing from one physician per 1,000 population to two physicians reduces infant mortality by 23% compared to the level before 1933. There is a similar effect in perinatal infant deaths and stillbirths. It did not appear to have an impact on premature births and congenital disorders, which are two prominent causes in developed countries. The increase in health care coverage reduces mortality, especially in epidemic diseases such as inflammatory bowel conditions, measles, influenza and bronchitis. The health care coverage effect was non-linear. Mortality effects do not appear at densities more than 2 doctors per thousand people. Health care coverage at a basic level is vital.

Prenatal care is an important pillar of health care and is a prominent factor in reducing infant mortality. Prenatal care initiated in the later stages of pregnancy can reduce infant mortality. In a study of the data on poor women in Uruguay, it was found that the increase in antenatal care increased birth weight (Todd Jewell & Triunfo, 2006).

There are also studies showing that prenatal care has no effect on infant mortality. Prenatal care is strongly associated with gestational age. Some neglected factors affecting infant mortality during pregnancy will relate prenatal care more with infant death. This will lead to incorrect estimation of the effect of antenatal care (Rosenzweig & Schultz, 1983; Wolpin, 1997).

2.1.6. Education

Education and health are related. "Mothers with secondary education are more likely to have children at later ages and to seek medical care during and after pregnancy". Developed countries generally do not allocate less than 4.5% of their gross domestic product for universal primary and secondary education(Andrews et al., 2008: 345).

Women's education and literacy are indicators of infant health. “The children of uneducated women in developing countries tend to be twice as likely to die or to be exposed to malnutrition at the time of childbirth than women who have completed secondary education. Women who are deprived of education and health services are likely to get married during or before puberty. Therefore, they become pregnant at a young age. The risk of perinatal asphyxia and birth trauma is high because the body cannot reach enough maturity” (Andrews et al., 2008: 350). According to World Health Organization, (2016a), approximately 637,000 newborn infants die from birth asphyxia and birth trauma every year in approximately the first four weeks of delivery.

Educated women tend to give birth with the help of specialist obstetricians who diagnose, manage high-risk situations. “In Nigeria, 88% of women with higher education receive birth by medical aid, while 15% of uneducated women are undergoing medical care. Specialist obstetricians are the basis for the prevention of neonatal mortality. They are trained to maintain clean delivery, perform resuscitation in the case of asphyxiation, and keep both mother and infant dry and warm” (Andrews et al., 2008: 350). Maitra (2004) jointly predicted health inputs, prenatal care, hospital maternity and infant mortality. The study stated that the demand for health inputs varied according to the balance of power among the parents. As a result of the study, it was observed that the education of women has a stronger effect on the use of health services than the education of the husband and it is more effective in the demand of prenatal care. This effect shows that mother's education is a more effective variable in reducing infant mortality compared to father's education. (Caldwell (1979) as a similar study)

Infants born to educated mothers have higher chances of survival than other groups. Educated mothers tend to get married late and have fewer children because they tend to have late children. In Sub-Saharan African countries, there is a weak relation between mother's education and infant mortality. Possible reasons can be explained. The linking of educated women in sub-Saharan countries with society may be weaker than women in most Asian and Muslim societies. As a result of the interaction of traditional practices with mother's education, it may be less than the infant deaths encountered by mothers who have received basic education for a few years. Another reason is that the poor health infrastructure in Sub-Saharan African countries may prevent for the use of information from educated mothers (Hobcraft & others, 1993).

“Mothers who have completed secondary education are more likely to breastfeed their babies immediately. Women who have completed their higher education, have higher socioeconomic status and have access to birth control tend to have family planning, at least twenty four months of birth interval and fewer children” (Andrews et al., 2008: 350).

In developed regions in Malaysia, educated women are more effective in reducing infant mortality. A minimum level of development may be necessary for the impact of mother's education (DaVanzo & Habicht, 1986).

The education of the father is one of the strong determinants of the determination of household assets and consumer goods. Childcare services are also included in consumer goods. This effect is more important for child survival for marriage of men and low educated women (Mosley & Chen, 1984).

2.1.7. Air Pollution

45% of deaths caused by pneumonia among children under five years of age are caused by inhaled particulate matter from household air pollution. Household air pollution also poses a risk for pneumonia in adults and accounts for 28% of all adult pneumonia-related deaths. 12% of all premature deaths due to stroke can be attributed to exposure to house air pollution during the day resulting from meals made with solid fuel and kerosene. “Improving indoor air quality reduces child and infant pneumonia and helps protect the developing fetus from stillbirth, perinatal complications and low birth weight. One third of the child deaths caused by smoking in the interior is taking place in the African continent, which is a great risk of death for low-income people living in Africa”. (WHO, 2018a).

2.1.8. Public Policy

Child health is one of the main issues of public policy in developing countries with relatively high infant mortality. Increasing per capita income is not enough to reduce IMRs. This situation is evident in the presence of poorer countries performing better than middle-income countries in lowering IMRs. In his study, Wang (2003) examined factors affecting infant and child mortality at both national and urban and rural levels. “Factors affecting the per capita income as well as access to electricity, vaccination in the first year of life, public health expenditure per capita and sanitation have been found to be effective at national level. From rural and urban perspective, access to electricity is the most important factor in urban areas; in rural areas, vaccination is more effective”.

Public policy can be directly or indirectly created to influence health input prices and to improve the efficiency of health production. While support can be made about prices, facilitation policies may be established for access to health inputs (Schultz, 1984).

2.2. INFANT MORTALITY BY DEVELOPMENT LEVELS

2.2.1. Infant Mortality in Developed Countries

The IMR at world in 2017 is 29.4 per thousand. This rate is down to 5.7 per thousand for the United States, while it falls to 3.45 per thousand for European Union countries (The World Bank, 2019c).

The historical development of infant mortality in developed countries is also a guide for developing countries. Historical development is explained on the basis of theory of demographic transition. Theory of demographic transition focuses on the three basic phases of the transition. In the first phase, high birth and mortality rates are experienced. In the second phase, the mortality rates started to decrease, and the birth rates remained high. In the third phase, birth rates begin to decrease while low mortality rates continue. According to the economic and social change of countries, the transition speed of these stages is changing (Todaro & Smith, 2003).

At the beginning of the 20th century, firstly the improvement of the living standards and deaths caused by infectious diseases decreased. As a result of these gains, measles, diphtheria and tetanus deaths are not experienced in developed countries. Due to these developments, postneonatal infant deaths caused by infectious diseases have started to decrease. Postneonatal infant deaths continued to decrease with the development of environmental and social effects such as implant sanitation, breastfeeding, and improvement of breastfeeding (Andrews et al., 2008: 355).

Improvements in perinatal care in the 1960s and 1970s also reduced neonatal deaths. Pregnancies in the high-risk group and low-weight infants were treated in NICUs. These specialist centers have become new effective therapy centers that have focused into high-risk fetuses and infants. “In the midwifery, prenatal ultrasound and fetal heart rate monitoring provided important diagnostic tools”. Since 1990, SIDS has been reduced by 50% with the development of good sleep and other risk-reducing strategies. Despite these developments, even in developed countries, some disadvantaged and high-risk groups have high IMRs. IMRs are less than 10 per thousand in 48 developed countries[2]. For these countries, infant deaths are due to premature birth, SIDS and congenital conditions (Andrews et al., 2008).

In developed countries, the status of infant mortality is examined by analyzing US data. In 2017 there were just over 3.862 million live births and nearly 22,335 infant deaths resulting in an IMR

[2] “Developed regions comprise Europe, North America, Australia, New Zealand, and Japan”

of 5.79 deaths per a thousand live births. In 2016, IMR was 5.87 per thousand. This change was not statistically significant. Infant mortality continues to decline in developed countries. The IMR in USA is more double than some other developed countries. Some important determinants in USA are two-thirds of infant deaths and they happen in neonatal period. The first ten causes of infant deaths in 2017 account for 67.8% of all infant deaths in the US. The first five reasons of infant mortality were congenital malformations (1.22 per thousand), low birth weight (0.97 per thousand), maternal complications (0.37 per thousand), SIDS (0.35 per thousand), and unintentional injuries (0.34 per thousand) (The National Center for Health Statistics, 2019).

Tavares (2017) tested the determinants of infant mortality by using robust regression and panel data regression technique for 28 countries in the European Union between 2005-2012. The mean IMR decreased from 5.1‰ to 3.8‰ between 2005-2012. Variables such as declining fertility rates and age are important in terms of sustainability of health systems. In this study, IMR was taken as 3 years averages and the median year was used as the year represented. OLS regression and robust regression estimation are used to account for possible outliers. Later, Hausman test is used to check if fixed effects are to be estimated. Wald test controls check the existence for heteroscedasticity in the fixed effects model. The income equity indicator and maternal age are significant explanatory variables in both OLS and robust with estimation with country dummies. Unemployment rate does not have statistical significance. The effect of public health expenditure is ambiguous. The percentage of people who have completed at least lower secondary education has no explanatory power except for some model specifications. This study shows in general "there is no significant correlation between the mean age of mothers having their first child and the infant mortality rate". Both GDP per capita and percentage of live births to mothers under age of twenty were stated to be the two main factors affecting mortality. In conclusion, control of pregnancy at adolescent age contributes to decrease of infant mortality in the European Union.

Another study investigating the effect of real per capita GDP on IMR in 25 OECD countries[3] was also conducted. The study included the data group between 1970 and 2007. First, the first-generation panel unit was root tested, then the stationary tests were applied. The results show that "real per capita GDP data can be rejected at the 5 % significance level in first difference and, while IMR is stationary at the 5 % significance level. The coefficient of -2.89 can be explained as 1 percent increases in real per capita GDP will lead to reduce the IMR in the ratio of 2.89

[3] "Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, The United Kingdom, and The United States"

percent". As a result, countries need to invest in innovation and raise the country's income if they want to be more successful and effective in reducing IMRs (Erdoğan, Ener, & Arıca, 2013).

2.2.2. Infant Mortality in Developing and Less Developed Countries

According to Andrews et al. (2008), 99% of infant and child deaths happen in developing countries and can be prevented by non-costly protection methods. "Most infant and youth deaths can be prevented by nutritional support for pregnant mothers, improved sanitation, providing access to clean water, immunization program for infantile diseases, the establishment of competent people, treatment of diarrhea and dehydration. Of the causes of infant deaths in developing countries, 36% were caused by infection (26% in pneumonia / sepsis, 7% in tetanus, 3% in diarrhea), 27% in premature birth complications, 23% in birth asphyxia and 7% of the cases were congenital abnormalities and 7% were the other group".

Eğri (1997) examined the determinants of IMRs for socio-economic and some other variables according to the national data of the developing and underdeveloped 56 countries between 1990-1995. Stepwise multiple regression technique was used to determine the relationship between IMRs and variables. Socio-economic variables such as income, literacy rate, infant rate which has LBW, calorie intake per person, percentage of population who can access to clean drinking water and health services and sanitation are used in the model. A one-unit increase in sanitation conditions and in per capita calorie intake and female literacy rate decreases by 0.55, 0.84, 0.77 in IMRs, respectively. It is stated that these three variables are responsible for 63% of infant deaths in this country group. In developing and underdeveloped countries, the percentage of utilization of sewerage and low environmental conditions cause widespread infectious diseases. In this case, food and water pollution and not being able to remove waste efficiently increase IMRs. Malnutrition caused by insufficient caloric intake causes infant mortality. Negative correlation between education of women and infant deaths is more prominent especially in postneonatal period. Low maternal education causes infants to be undernourished and not to benefit from health services.

Subramaniam, Loganathan, Yerushalmi, Devadason, & Majid (2018) stated that IMRs for the four selected "Association of Southeast Asian Nations (ASEAN)" member countries[4] decreased between 1980 and 2013. There are differences between countries in decreasing infant mortality. Autoregressive Distributed Lag (ARDL) Error Correction Model was used to measure short-term

[4] "Indonesia, Malaysia, Philippines, Thailand"

and long-term relationships between IMR and independent variables of the model such as female fertility rates, access to healthcare, income, female education levels. For the four selected countries, factors affecting IMRs differ. For Indonesia, access to healthcare and female education seem to be the two most important factors. For Philippines, access to healthcare and fertility reduction are two key factors in the reduction of infant mortality. While income level is effective for Malaysia, female education is the main factor for Thailand. Indonesia and the Philippines are in the low middle-income countries, Thailand and Malaysia are in the high middle-income countries. For low middle-income countries, access to healthcare is the most effective factor in reducing infant mortality, while income and education are likely to be influential for high middle-income countries. In terms of the type of infant mortality in ASEAN, deaths in the neonatal period were equal in 1990 and deaths in the postneonatal period were equal in 1990, whereas in 2012, the share of neonatal deaths started to be higher and neonatal deaths accounted for 49% of children under five years of age. This shows the structural change in infant mortality and reflects the type of situation faced by developing countries. Most infant deaths in ASEAN consist of preventable afflictions. Pneumonia (17 percent of infant deaths), Diarrhea (9 percent of infant deaths) and malaria (7 percent of infant deaths) are the main causes of death.

IMRs and child deaths under five years were investigated in a study conducted in socioeconomic groups or geographic locations by using data from 60 low-income countries[5]. In this study where mortality rates are considered as health output, variables are defined in national, urban and rural areas. The study covering the period between 1985-1990 was carried out with a five-year period analysis. Model variables consist of income, social and environmental indicators (female education, access of sanitation, access to safe water), policy indicators (the share of public health expenditure in GDP) and country specific effects (level of urbanization, the quality of government and cultural effects). According to the regression results “at the national level, the variables of income, share of health expenditure to GDP, access to sanitation, access to electricity, and vaccination coverage in first year of life were statistically significant variables affecting infant mortality rate”. These variables explain IMR at 88%. Although female education and access to safe water were important variables, they were not statistically significant difference in the tests. In urban areas, access to electricity is the biggest factor affecting IMR although asset index and share of health expenditure in GDP is significant. “In rural areas, none of the variables were statistically significant except for access to electricity level. The increase of average share of health expenditure in GDP decreases IMR in urban areas but it is not effective in rural areas. The results of the tests for U5MR are similar to those for IMR. The effect of access to electricity in

[5] “Sub-Saharan Africa, Asia, Latin America and Caribbean countries”

U5MR is more than twice the effect on IMR. Direct health interventions, such as improving access to electricity or increasing vaccination coverage to reduce child mortality, will be more effective than focusing on GDP growth" (Wang, 2003).

Younger (2001) examined the reasons for the decrease in IMRs by using an unbalanced panel. A cross country model using growth regression specification was test. The model is divided into two parts as absolute convergence and conditional convergence. Absolute convergence shows that, in contrast to the GDP per capita, the poorer countries with high IMR are catching up to a few decades in richer countries with low IMR. In country fixed effects, when the conditional convergence is examined, the percentage reduction in IMR is larger for countries which have high IMR. Conditional convergence is stronger than absolute convergence. This situation shows that countries have IMRs in different balances. When looking at policy effects, doubling of real GDP per capita provides a reduction of 1.5 infant mortality per thousand in IMR. Contrary to the literature, secondary schooling ratio has different than expected. When we include only two policy variables to fixed effects, the primary school enrolments and DPT vaccination for infants reduce infant mortality. Health care units (doctors, nurses, and hospital beds per 1,000 inhabitants) have no effect on the reduction of IMR, and the coefficients of these variables are generally positive. This can be explained by the fact that the variables are measured in urban areas and that formal sector health care is not available to poor people which have a risk of death of their children. As a result, "both the number of physicians and the number of hospital beds did not have a significant effect on the reduction of infant mortality".

The countries with the lowest IMRs and the countries with the least developed countries are African countries. In the panel data empirical analysis study for 53 African countries between 2000 and 2009, IMR was chosen as the dependent variable. The independent variables were fertility rate, GDP per capita, public health spending, prevalence of HIV, and female labor force participation. Random effect model was used in a two-stage least squares analytical method correcting for endogeneity problem. Results shows that fertility rate significantly affects IMR in a positive sign. Similarly, "GDP per capita and government expenditure in health have an effect on infant mortality rate in the estimates of -14.291 and -5.536 respectively". Participation of adult female in labor force and the prevalence of HIV both have positive sign on infant mortality, but these estimates have low impact compared to other variables. This study shows that "governments are less likely to experience a rapid decline in infant mortality rates in African countries, which place low emphasis on individual family health (such as appropriate family planning precaution), economic growth, and provision of adequate health care" (Osawe, 2014).

In addition to many studies that emphasize the effects of economic and social modernization on infant mortality, there is also a study which includes political modernization and dependency perspective. In the panel regression analysis study covering 59 developing countries, the effects of export, multinational corporations' investments and dependency relationships based on international lending institutions were investigated. “Dependent variable is infant mortality in 1997 and lagged dependent variable is infant mortality in 1980. Data for independent variables were between 1975-1980. Dependent and lagged dependent variable are logged to reduce the potential problem of heteroskedasticity in analysis. Results affirm that economic and social modernization hypotheses remark that high levels of development and education help to decrease infant mortality in the developing countries. Dependency relationships based on exports, multinational corporations and international lending institutions lead to lower levels of infant mortality more strongly at lower levels of democracy than at higher levels of democracy”. In developing countries, governments should support non-governmental organizations, workers' unions, institutional structures in legal frameworks. These organizations should also put pressure on the public to provide health and social services (Shandra, Nobles, London, & Williamson, 2004).

2.2.3. Infant Mortality in Turkey

There are many studies on determinants of IMR in Turkey. Most of these studies examine infant mortality at a provincial or district level. Some of these studies are included in this title. The studies of IMR at the national level in Turkey is more space separated in this title.

In a study conducted in Gölbaşı district of Ankara, it was tried to determine the infant deaths and the factors affecting in the districts and villages. This study was nested case-control study. A questionnaire was used to collect data. The study was conducted between April and July 2001. In 2000, the population of the zero-age group was 1004, the number of live births was 774, the IMR was 14.21 per thousand, the NMR was 9.04 per thousand, the PMR was 5.17 per thousand, and the perinatal mortality rate was 12.92 per thousand. The effect of various factors on infant mortality was investigated by logistic regression technique. The birth place, the state of the infants’ health check, the breastfeeding status of the infants, the number of pregnancies of the mothers and the birth weight of the infants were found to be statistically significant on infant deaths. There was no effect of mothers' literacy status, gestational age of mothers, and gender of infants on infant mortality. Breastfeeding is the most important factor in infant mortality. The babies of mothers who breastfeed their babies are at the risk of death more than 42.51 times more

than the babies of the mothers who breastfeed their babies. The second most effective factor is the birth place. It is associated with inaccessibility to health services. The risk of death is 15.87 times higher in the babies of mothers who have had their birth at home or in their own neighborhood (Özkan, Bakar, Maral, & Bumin, 2009).

In another study, IMR and NMR were used as a parameter between 2007-2012. All data were performed for 12 geographical regions to show the difference between regions. Descriptive analysis was performed to define the changes in IMR and NMR according to year and geographical region. In both 2007 and 2012, "prematurity, congenital anomalies and congenital heart diseases are the three most common causes of infant mortality", but are mostly seen in Istanbul, Marmara and Western Anatolia. These regions are also lower than the average IMR of Turkey. "Number of infants per pediatrician, number of infants per doctor and number of infants per midwife are mentioned as factors increasing IMR". "Increased number of hospital birth, caesarean delivery, adequate antenatal care, infants follow up, staff trained within neonatal resuscitation programme have been identified as a reducing factor for IMR". The rate of Measles-Mumps-Rubella (MMR) vaccination at 12 month of age and the number of NICU beds per 1,000 live births were implicated as non-effect factors on IMR. These regions are also lower than the average IMR of Turkey. As a result, "congenital anomalies and birth injuries decreased in the 1990s and respiratory distress syndrome, sudden infant death syndrome (SIDS) and metabolic diseases started to increase. This shows that the causes of death are changing similar to those of developed countries" (Dilli et al., 2016).

In another study in which the IMR was dependent variable, the potential determinants of the health level in 2008-2014 period and 81 provincial levels were analyzed by Fixed Effects Spatial Lag Panel model method. According to the estimated model results, the factors that determine the health status are income and social health insurance in Turkey. A 10% increase in income level reduces the IMR by 18.1%. A 10% increase in the share of the population covered by social security is seen to reduce the IMR by 7.5%. The 10% increase in total hospital number and urbanization rate in access to health care services was found to decrease IMR by 4.1% and 4.2%, respectively. In terms of education, a 10% increase in the share of higher education (university) in the total population reduces the IMR by 2.9%. It was determined that the health incentives given to the health sector and the technology variable were statistically insignificant. According to the spatial effect analysis, an increase of 10% in the average health level of the neighbors of a province increases the health level of the province by 5.3%. As a result, the effect of health infrastructure and equipment on decreasing IMR is decisive; however, it is stated that socio-

economic variables such as income have a higher effect on determining health output (Manavgat & Celik, 2017).

In another study, infant deaths that occurred in Turkey and regional relationships between the family and the individual properties have been investigated. TDHS data conducted by "Hacettepe University Institute of Population Studies" in 2003-2004 were used. 7360 mothers and 21985 children are covered by the data. 1350 infant mortality cases occurred. Time analysis methods were used in the study. The results of the study indicate that birth intervals are associated with the risk of infant mortality in poor families. The difference between the risk of infant mortality among rich and poor families was found to be significant for the richest group. On the other hand, the statistical significance of this difference is eliminated when the variables such as the birth place, antenatal care and birth intervals are added. The risk of death of infants in which birth intervals are less than 14 months is higher than other births. Breast milk is associated with the risk of death in the first two months of the infant's life. "Birth place is associated with infant mortality rates. The source of water used by the family is related to the chances of survival of the infant. It is stated that families using well water are in the worst condition in terms of risk of infant mortality. There was a curvilinear relationship between the maternal age at birth and the risk of infant mortality, indicating that the young and older mothers are at higher risk of infant mortality". It was found that the mother who received any education level was not statistically significant for the survival of the infant (Seckin, 2009).

Çukur & Bekmez (2011) examined the effect of income and inequality of income on IMR for Turkey's five regions (North, South, Central, East and West) between the years 1975 to 2001. In the study, the regional data were analyzed by the pooled OLS and panel data methods of fixed effects and first difference estimations. The protective effect of income on infant mortality was observed. Income inequality is a factor that increases the IMR. Besides infrastructure (clean water, sewage), access to healthcare (public health policy and public health spending), education (especially maternal education) variables have a significant role in upgrading our health outcomes such as the removal of regional disparities in Turkey, especially the equitable distribution of public health services.

CHAPTER 3

DIFFERENCES IN IMR & IMR IN STATISTICAL REGIONS OF TURKEY

3.1. DIFFERENCES IN IMRs

Different values of IMRs are observed in data sets of different reports and organizations. Records of infant deaths are held by "Turkey Maternal and Child Health and Family Planning General Directorate", "Turkey Public Health Agency" and institutions such as the "Turkey Statistics Institute (TURKSTAT)". Table 3 shows IMRs in Turkey (in 1,000 live births) according to different institutions.

Table 3: Infant Mortality Rates by Institutions

	2009	2010	2011	2012	2013	2014	2015	2016	2017
MH-HSY	10.2	7.8	7.7	7.4	7.8	7.6	7.6	7.3	6.8
TURKSTAT	13.9	12	11.6	11.6	10.8	11.1	10.2	9.9	9.2
UNICEF-SOWC	19	14	12	12	17	-	12	11	-
WHO-WHS	18	12	12	12	16.5	-	-	-	-
TDHS	-	-	-	-	13	-	-	-	-

Source: MH-HSY 2010-2017, TURKSTAT Vital Statistics, UNICEF-SOWC 2011-2017, WHO-WHS 2015, TDHS 2013

The fact that the IMRs are not taken from a single source in the Health Statistics Yearbook (HSY) published by the Ministry of Health (MH) makes the accuracy of the decline trend of the values questionable. In HSY 2010, both 2009 and 2010 values were obtained from the MCH General Directorate and the data from previous years were obtained from the TDHS (The Republic of Turkey Ministry of Health, 2011). In HSY 2011, Infant and Under Five Mortality Research made by universities[6] and Turkey Public Health Agency Data were used (The Republic of Turkey Ministry of Health, 2012: 14). Therefore, the IMRs show different values for the same years in HSY 2010 and 2011. Retrospective IMRs were not shown since HSY 2012 (The Republic of Turkey Ministry of Health, 2013). The Turkish Public Health Agency has been cited for the data

[6] Istanbul University, Marmara University, Yıldırım Beyazıt University

between 2012 and 2015. The General Directorate of Public Health has been used as a source since HSY 2016 (The Republic of Turkey Ministry of Health, 2017).

IMRs in TURKSTAT are began in 2009. The data are composed of data from "The Ministry of Interior, General Directorate of Civil Registration and Nationality, the Central Civil Registration System (MERNIS), TURKSTAT Causes of Death Data and data sent by related institutions". Values published at provincial level were obtained from the same sources (Turkish Statistical Institute, 2018).

IMRs in "The State of World's Children Reports (SOWC)" constituted by "United Nations International Children's Emergency Fund (UNICEF)" are taken from "the United Nations Inter-Agency Group for Child Mortality Estimation". The 2015 report and all previous reports give the values of two years ago, while the 2016 report gives the value of the previous year. Therefore, the 2014 IMR is not included.

The IMRs was given in 2013 in the latest WHS 2015 report (The World Health Organization, 2015). Because Article 4 of the MDGs is a two-thirds reduction of child mortality below 5 years of age. In this context, the values of infant mortality were also included in the World Health Statistics. Since 2016, these statistics do not include IMRs, but NMRs included.

TDHS are conducted by "Hacettepe University Institution of Population Studies". Data on infant mortality is obtained by questioning the birth history in a women's questionnaire. Queries are conducted for five-year periods. The TDHS reports were published in 1993, 1998, 2003, 2008 and 2013. The average IMR were 17 in TDHS 2008 and 13 in TDHS 2013 (Hacettepe University Institution of Population Studies, 2014).

The reason for the difference in IMRs is due to differences in reporting technique. The reporting criteria for "the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)" are as follows:

"The legal requirements for the registration of fetal deaths and live births vary from country to country and even within countries. If possible, all fetuses and infants weighing at least 500 g at birth, whether alive or dead, should be included in the statistics. When information on birth weight is unavailable, the corresponding criteria for gestational age (22 completed weeks) or body length (25 cm crownheel) should be used." (The World Health Organization, 2010)

The HSY have indicated that deaths of IMRs for the period between 2008 and 2010 are at least 22 weeks of gestational age. According to the revision made in 2011, it has been taken into consideration that deaths of gestational age at least 28 weeks and above have been taken into

consideration since 2011. In the HSY 2012, IMR, NMR, PMR, U5MR were considered and the deaths in live births with a gestational age of 28 weeks and above or 1000 gr birth weight were taken into consideration. IMRs are based on deaths of 500 g or more, or gestational age of 22 weeks and over according to Turkey Public Health Agency. The Ministry of Health calculates gestation age based on 28 weeks instead of 22 weeks. So, IMRs are showed lower. In addition, the findings of the TDHS and the findings of the General Directorate of MCH were not calculated by using the same method. The TDHS presents data on community-based research but, General Directorate of MCH presents IMRs according to notifications (Eskiocak & Selçuk, 2014).

3.2. THE IMR IN TURKEY AT THE NATIONAL LEVEL AND THE SUBREGION

3.2.1. Statistical Regions

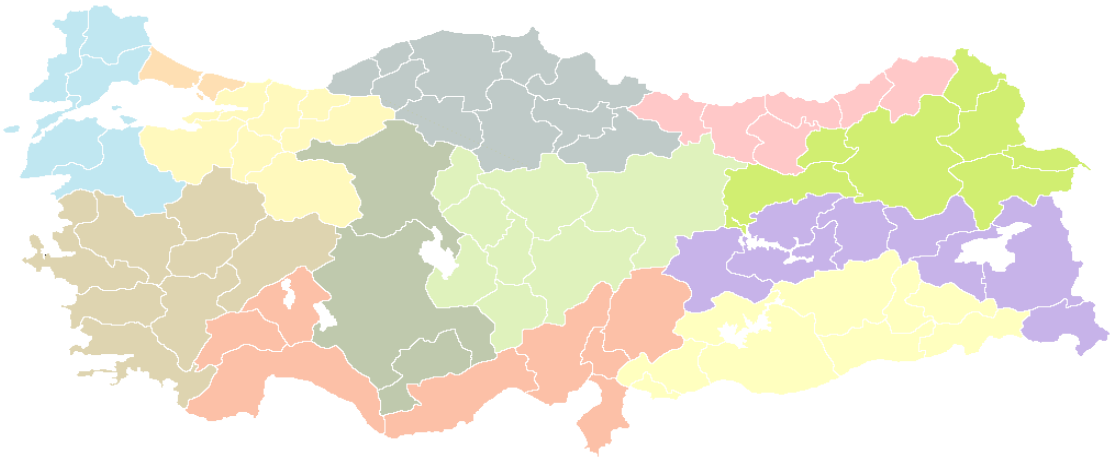
The Statistical Region Units Classification (SR) has been established by TURKSTAT "to collect and develop regional statistics, to make socio-economic analyzes of regions, to determine the framework of regional policies and to create a comparable statistical database suitable for the European Union Regional Statistics System". Statistical Regions are made according to the geographical characteristics of the provinces, the same potential characteristics of the provinces (eg agriculture, industry or service intensive regions) and population amounts. SR Level 3 consists of 81 provinces. Each province defines the Statistical Region Unit. Level 2 IBBS consists of 26 regions defined by grouping of neighboring provinces. Level 1 IBBS is the defined level of the 12 regions by regrouping 26 regions. Socioeconomic and culturally similar provinces with similar characteristics are grouped in 2nd level regions. Eurostat stipulates that regional plans are to be made in accordance with Level 2 regions (Taş, 2006). Figure 1 and the Table 4 shows statistical regions of Turkey are constituted according to SR Level 1.

Table 4: Statistical Regions by Codes and Levels

Codes	SR - Level 1	SR - Level 2	SR - Level 3
TR1	İstanbul	İstanbul Subregion	İstanbul
TR2	West Marmara	Tekirdağ Subregion	Tekirdağ, Edirne, Kırklareli
		Balıkesir Subregion	Balıkesir, Çanakkale
TR3	Aegean	İzmir Subregion	İzmir
		Aydın Subregion	Aydın, Denizli, Muğla
		Manisa Subregion	Manisa, Afyonkarahisar, Kütahya, Uşak
TR4	East Marmara	Bursa Subregion	Bursa, Eskişehir, Bilecik
		Kocaeli Subregion	Kocaeli, Sakarya, Düzce, Bolu, Yalova
TR5	West Anatolia	Ankara Subregion	Ankara
		Konya Subregion	Konya, Karaman
TR6	Mediterranean	Antalya Subregion	Antalya, Isparta, Burdur
		Adana Subregion	Adana, Mersin
		Hatay Subregion	Hatay, Kahramanmaraş, Osmaniye
TR7	Central Anatolia	Kırıkkale Subregion	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir
		Kayseri Subregion	Kayseri, Sivas, Yozgat
TR8	West Black Sea	Zonguldak Subregion	Zonguldak, Karabük, Bartın
		Kastamonu Subregion	Kastamonu, Çankırı, Sinop
		Samsun Subregion	Samsun, Tokat, Çorum, Amasya
TR9	East Black Sea	Trabzon Subregion	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane
TRA	Northeast Anatolia	Erzurum Subregion	Erzurum, Erzincan, Bayburt
		Ağrı Subregion	Ağrı, Kars, Iğdır, Ardahan
TRB	Centraleast Anatolia	Malatya Subregion	Malatya, Elazığ, Bingöl, Tunceli
		Van Subregion	Van, Muş, Bitlis, Hakkari
TRC	Southeast Anatolia	Gaziantep Subregion	Gaziantep, Adıyaman, Kilis
		Şanlıurfa Subregion	Şanlıurfa, Diyarbakır
		Mardin Subregion	Mardin, Batman, Şırnak, Siirt

Source: TURKSTAT, Classification Server (2010)

Figure 1: The Map of Turkey according to Statistical Level 1



Source: Turkish Maternity, Child and Adolescent Health Institute

3.2.2. Examination of IMRs by Statistical Regions

The IMR gives the number of infant deaths per thousand live births in a given year. The data collection system was amended in 2009. Before 2009, information on the deaths were compiled on the basis of the Death Statistics Form. As of 2009, information on the deaths from "MERNIS (The Central Civil Registration System)" database is based on the "MERNIS Death Notification Form 2009". In addition, death data were collected based on the provincial and district centers where the death incident occurred between 1957 and 2008, and from 2009 based on permanent residence in the province and district. Due to the death data collected using a new system, comparison with the years before 2009 was not considered appropriate in this study. The numbers of infants who died in the neonatal and postneonatal period on a regional basis were compiled from the count of daily and monthly infant deaths according to the classification and gender of the statistical district units compiled from TURKSTAT database. In the 2009-2017 period, the situation was examined for each region according to the national level and IBBS level 1. Both infant death rate and IMR were examined.

3.2.2.1. Turkey (National Level)

Table 5: Infant, Neonatal, Postneonatal Deaths in Turkey, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	17,607	15,164	14,567	14,974	14,027	14,951	13,666	13,006	11,849
Neonatal Deaths	11,381	9,648	9,183	9,838	9,082	9,955	8,769	8,402	7,633
Postneonatal Deaths	6,220	5,516	5,384	5,136	4,945	4,996	4,897	4,604	4,216

Source: TURKSTAT, Vital Statistics

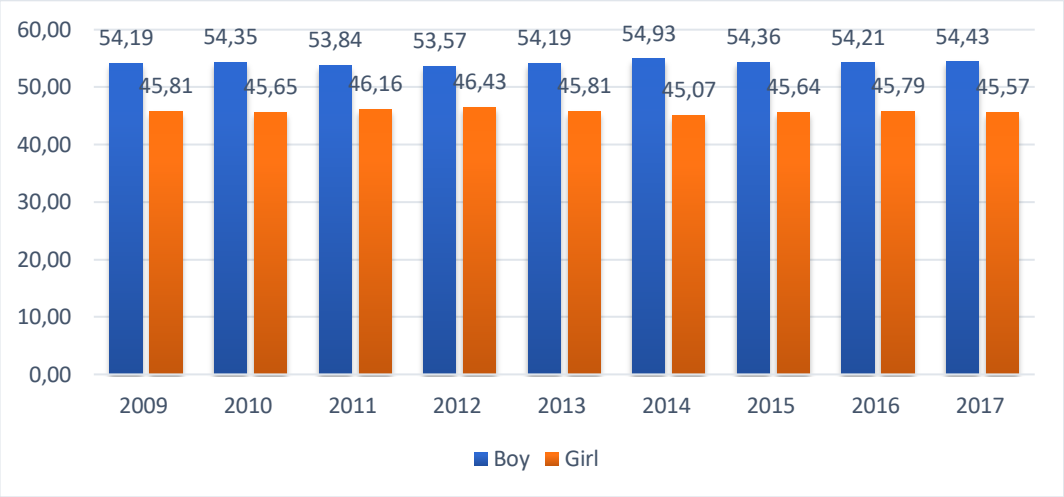
In Turkey, while there was a total of 17.607 infant deaths in 2009, this number decreased to 11.849 in 2017. In the period mentioned, 65% of the deaths are caused by neonatal deaths and 35% by postneonatal deaths. When the number of infant deaths was taken as the base year of 2009, a decrease of 32.70% was achieved in 2017. Although there was a decrease in the general tendency of infant deaths, there was an increase in 2012 and 2014. Table 6 shows gender-separated death rates.

Table 6: IMR, NMR, PMR by Gender in Turkey, 2009-2017

		Years								
		2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Mortality Rate	Total	**13.9**	**12.0**	**11.6**	**11.6**	**10.8**	**11.1**	**10.2**	**9.9**	**9.2**
	Boy	14.6	12.7	12.2	12.1	11.4	11.8	10.9	10.5	9.7
	Girl	13.1	11.3	11.0	11.0	10.2	10.3	9.6	9.3	8.6
Neonatal Infant Mortality Rate	Total	**8.9**	**7.6**	**7.3**	**7.5**	**6.9**	**7.3**	**6.5**	**6.3**	**5.8**
	Boy	9.6	8.2	7.8	8.0	7.4	7.9	7.1	6.8	6.3
	Girl	8.1	6.9	6.7	7.0	6.3	6.5	5.9	5.8	5.3
Postneonatal Infant Mortality Rate	Total	**5.0**	**4.5**	**4.4**	**4.1**	**3.9**	**3.8**	**3.8**	**3.6**	**3.4**
	Boy	5.0	4.5	4.4	4.0	4.0	3.9	3.8	3.7	3.5
	Girl	5.0	4.4	4.4	4.1	3.9	3.7	3.7	3.5	3.3

Source: TURKSTAT, Vital Statistics

Figure 2: Gender Proportion in Infant Mortality Rate, Turkey, 2009-2017



Source: TURKSTAT, Vital Statistics

IMR, which is formed by showing both gender discrimination and sub-branches of IMRs, is seen to have a downward trend except for the years 2012 and 2014. Although the number of infant deaths increased in 2012 due to deaths in the neonatal period, the rate is the same as the previous year. In 2014, there is an increase in both number and rate. When the year 2009 was taken as the base year, the IMR decreased by 33.97% in 2017. The average annual decrease is 4.94%. Figure 2 shows that male infants die more than female infants. The male IMR has a share 54-55% while the female IMR has a share 45-46%.

When the NMR, which defines the IMR that occurred within the first 28 days, was taken as the base year of 2009, a decrease of 34.57% was achieved in 2017. PMR, which defines the IMR that occurred within one year from the 29th day, decreased by 32.84%. Although the decrease in NMRs is higher than the decrease in PMRs, the decrease rates are close to each other. Considering the gender differences, the rate of death of male infants in neonatal period is higher than that of female infants. For the postneonatal period, these ratios are almost the same.

3.2.2.2. İstanbul

Table 7: Infant, Neonatal, Postneonatal Deaths in İstanbul, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	2,405	2,062	1,693	1,943	1,840	2,149	1,991	1,948	1,724
Neonatal Deaths	1,539	1,309	1,074	1,257	1,184	1,383	1,258	1,257	1,122
Postneonatal Deaths	861	753	619	686	656	766	733	691	602

Source: TURKSTAT, Vital Statistics

While a total of 2,405 infant deaths occurred in Istanbul in 2009, this number decreased to 1,724 in 2017. In the period mentioned, 64% of the deaths are caused by neonatal deaths and 36% by postneonatal deaths. When the count of infant deaths was taken as base year of 2009, a decrease of 28.32% was achieved in 2017. The decrease in neonatal and postneonatal deaths is also close to the decrease in the count of infant deaths. Although there was a decrease in the general trend in infant deaths, there was an increase in 2012 and 2014. Table 8 shows the gender-separated IMR.

Table 8: Infant Mortality Rates by Gender in İstanbul, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	11.4	9.6	7.9	8.6	8.0	8.9	8.2	8.1	7.4
Boy	12.1	10.4	8.3	9.3	8.6	9.8	8.9	8.6	7.9
Girl	10.7	8.9	7.6	7.8	7.4	7.9	7.5	7.6	6.9

Source: TURKSTAT, Vital Statistics

It is seen that the IMR has a downward trend except for 2012 and 2014 years. In 2012 and 2014, there is an increase in both numbers and rates. When the year 2009 was taken as the base year, the infant mortality rate decreased by 34.86% in 2017. The average annual decrease is 4.75%. The male IMR is more than female IMR in the period mentioned.

3.2.2.3. West Marmara

Table 9: Infant, Neonatal, Postneonatal Deaths in West Marmara, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	483	372	342	407	344	328	288	265	307
Neonatal Deaths	342	262	231	293	233	224	184	177	191
Postneonatal Deaths	141	110	111	114	111	104	104	88	116

Source: TURKSTAT, Vital Statistics

While 483 infant deaths occurred in West Marmara Subregion in 2009, this number decreased to 307 in 2017. In 2009, 71% of deaths were caused by neonatal deaths and 29% by postneonatal deaths. While the share of neonatal deaths decreased to 62% in 2017, the share of postneonatal deaths increased to 38%. When the year 2009 was taken as the base year, the rate of infant mortality was decreased by 36.44% in 2017. In deaths occurring during the neonatal period, a reduction of 44.15% and deaths in the postneonatal period was 17.73%. Although the general trend in infant deaths decreased, there was an increase in 2012 and 2017. While the increase in 2012 was mainly due to the increase in neonatal deaths, the increase in 2017 was due to the increment in count of deaths occurring in neonatal and postneonatal periods. Table 10 shows the gender-separated IMR.

Table 10: Infant Mortality Rates by Gender in West Marmara, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	13.3	10.3	9.2	10.6	8.9	8.2	7.1	6.6	7.5
Boy	15.0	11.2	10.7	11.2	9.6	8.8	7.9	6.3	8.7
Girl	11.5	9.2	7.7	9.9	8.1	7.5	6.3	6.8	6.3

Source: TURKSTAT, Vital Statistics

The IMR is seen to have a downward trend except for the years 2012 and 2017 in the Table 10 formed by showing gender discrimination in IMRs. In 2012 and 2017, there is an increase in both number and ratio. When the year 2009 was taken as the base year, the IMR decreased by 43.24% in 2017. The average annual decrease is up to 6.01%. The male IMR is more than female IMR in the period mentioned except 2016.

3.2.2.4. Aegean

Table 11: Infant, Neonatal, Postneonatal Deaths in Aegean, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	1,857	1,465	1,435	1,541	1,145	1,226	1,211	1,145	1,029
Neonatal Deaths	1,290	1,054	1,002	1,123	766	854	814	803	701
Postneonatal Deaths	567	411	433	418	379	372	397	342	328

Source: TURKSTAT, Vital Statistics

While a total of 1,857 infant deaths occurred in the Aegean Subregion in 2009, this figure decreased to 1,029 in 2017. The share of neonatal deaths is 69% of the deaths, 31% of deaths are postneonatal deaths. When the year 2009 was taken as the base year, the IMR was decreased by 44.59% in 2017. The reduction rates of neonatal and postneonatal deaths are also close to the reduction in amount of infant deaths. Although there was a decline in the general trend in infant deaths, there was an increase in 2012 and 2014. Table 12 shows the gender-separated IMR.

Table 12: Infant Mortality Rates by Gender in Aegean, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	14.3	11.4	11.2	11.6	8.7	8.9	8.8	8.6	7.8
Boy	15.3	12.1	11.5	12.3	9.2	9.4	9.4	9.1	8.5
Girl	13.3	10.7	11.0	10.8	8.1	8.4	8.3	8.0	7.1

Source: TURKSTAT, Vital Statistics

It is seen that the IMR has a downward trend except for 2012 and 2014 years. In 2012 and 2014, both numbers and ratios increased. When the year 2009 was taken as the base year, the IMR decreased by 45.46% in 2017. The average annual decrease is 6.74%. The male IMR is more than female IMR in the period mentioned.

3.2.2.5. East Marmara

Table 13: Infant, Neonatal, Postneonatal Deaths in East Marmara, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	1,290	1,001	976	1,026	886	967	879	916	816
Neonatal Deaths	910	694	669	761	597	691	608	606	555
Postneonatal Deaths	380	307	307	265	289	276	271	310	261

Source: TURKSTAT, Vital Statistics

In the East Marmara Subregion, a total of 1,290 infant deaths occurred in 2009, while in 2017 it fell to 816. The share of the deaths is 69% of the deaths, 31% of the deaths are postneonatal deaths. When the year 2009 was taken as the base year, the number of infant deaths in 2017 was decreased by 36.74%. The number of neonatal deaths decreased by 39.01% and the number of postneonatal deaths decreased by 31.32%. Although the general trend in infant deaths decreased, there was an increment in 2012, 2014 and 2016. The increment in count of infant deaths in 2012 and 2014 is due to the increment in count of neonatal deaths, and the increase in the count of infant deaths in 2016 is due to the increment in count of postneonatal deaths. Table 14 shows the gender-separated IMR.

Table 14: Infant Mortality Rates by Gender in East Marmara, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	12.8	10.0	9.8	9.8	8.4	8.7	7.8	8.1	7.2
Boy	13.8	10.6	10.1	10.1	9.2	9.6	8.9	9.0	8.1
Girl	11.7	9.3	9.5	9.4	7.5	7.8	6.7	7.2	6.3

Source: TURKSTAT, Vital Statistics

The IMR is seen to have a downward trend except for the years 2012, 2014 and 2016 in the Table 14 formed by showing gender discrimination in IMRs. Although the count of infant deaths increased in 2012, IMR is the same as in previous year. In 2014 and 2016, there is an increase in both number and rate. When the year 2009 was taken as the base year, IMR decreased by 43.45% in 2017. The average annual decrease is up to 6.47%. The male IMR is more than female IMR in the period mentioned.

3.2.2.6. West Anatolia

Table 15: Infant, Neonatal, Postneonatal Deaths in West Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	1,441	1,233	1,206	1,142	1,029	947	941	899	906
Neonatal Deaths	1,038	892	877	788	669	609	632	615	612
Postneonatal Deaths	403	341	329	354	360	338	309	284	294

Source: TURKSTAT, Vital Statistics

While 1,441 infant deaths occurred in the West Anatolia Subregion in 2009, this figure decreased to 906 in 2017. In 2009, 72% of infant deaths were caused by neonatal deaths and 28% were caused by postneonatal deaths. While the share of neonatal deaths decreased to 68% in 2017, the share of postneonatal deaths increased to 32%. When the year 2009 was taken as the base year, the number of infant deaths decreased by 37.13% in 2017. The number of neonatal deaths decreased by 41.04%, and the number of postneonatal deaths decreased by 27.05%. Although the overall trend in the number of infant deaths decreased, only in 2017 there was an increase. Table 16 shows the gender-separated IMR.

Table 16: Infant Mortality Rates by Gender in West Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	13.4	11.5	11.2	10.3	9.1	8.1	8.0	7.7	7.9
Boy	14.2	12.3	12.3	11.0	9.2	8.3	8.3	8.2	8.3
Girl	12.5	10.7	10.0	9.5	9.1	7.9	7.8	7.2	7.6

Source: TURKSTAT, Vital Statistics

In the Table 16 formed by showing gender discrimination, it is observed that IMR has been decreasing except for 2017 as the years passed. In 2017, both numbers and rate increased. When the year 2009 was taken as the base year, IMR decreased by 40.75% in 2017. The annual average decrease is 6.18%. The male IMR is more than female IMR in the period mentioned.

3.2.2.7. Mediterranean

Table 17: Infant, Neonatal, Postneonatal Deaths in Mediterranean, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	2,294	2,011	1,983	2,033	1,972	2,047	1,772	1,721	1,522
Neonatal Deaths	1,515	1,284	1,287	1,360	1,294	1,423	1,142	1,159	999
Postneonatal Deaths	779	727	696	673	678	624	630	562	523

Source: TURKSTAT, Vital Statistics

A total of 2,294 infant deaths occurred in the Mediterranean Subregion in 2009, while this figure decreased to 1,522 in 2017. Within the said period, 66% of the deaths are caused by neonatal deaths and 33% by postneonatal deaths. When the year 2009 was taken as the base year, the count of baby deaths decreased by 33.65% in 2017. The number of neonatal deaths decreased by 34.06% and the number of postneonatal deaths by 32.86%. Although the general trend in the number of infant deaths decreased, there was an increase in 2012 and 2014. The increase in the number of baby deaths in these years is due to the increment in count of baby died in neonatal period. Table 18 shows the gender-separated IMR.

Table 18: Infant Mortality Rates by Gender in Mediterranean, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	13.7	12.1	12.1	12.0	11.6	11.6	10.2	10.1	9.2
Boy	14.4	12.8	12.9	12.1	12.4	12.5	10.8	11.0	10.0
Girl	12.9	11.4	11.3	11.8	10.6	10.6	9.5	9.0	8.3

Source: TURKSTAT, Vital Statistics

IMR, which was formed by showing gender discrimination, has been observed to decrease in the years except 2011 and 2014. Although the count of infant deaths reduced in 2011, IMR is the same as previous year. This shows that the amount of live births in 2011 is less than in 2010. Although the count of infant deaths increased in 2014, the IMR was the same as previous year. When the year 2009 was taken as the base year, the IMR decreased by 32.85% in 2017. The average annual decrease is 4.73%. The male IMR is more than female IMR in the period mentioned.

3.2.2.8. Central Anatolia

Table 19: Infant, Neonatal, Postneonatal Deaths in Central Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	799	698	688	678	580	635	629	517	509
Neonatal Deaths	494	432	397	446	374	441	436	315	349
Postneonatal Deaths	305	266	291	232	206	194	193	202	160

Source: TURKSTAT, Vital Statistics

While a total of 799 infant deaths occurred in the Central Anatolia Subregion in 2009, this figure decreased to 509 in 2017. In 2009, 62% of infant deaths were caused by neonatal deaths and 38% were caused by postneonatal deaths. While the share of neonatal deaths increased to 68% in 2017, the share of postneonatal deaths decreased to 32%. When the year 2009 was taken as the base year, the count of infant deaths decreased by 36.30% in 2017. The count of neonatal deaths decreased by 29.35% and the count of postneonatal deaths decreased by 47.54%. Although the overall trend in the number of infant deaths decreased, there was increment in 2014. The increase in the count of infant deaths in this year is due to the increment in the count of infants died in neonatal period. The decrease rate of postneonatal deaths is higher than the decrease rate in neonatal deaths and this shows that the structure of the factors causing infant mortality has changed. In general, although the number of deaths in infants has decreased, the share of neonatal deaths in deaths has increased. It appears that the distribution of a suitable share to the other western regions has reached over time. Table 20 shows the gender-separated IMR.

Table 20: Infant Mortality Rates by Gender in Central Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	11.9	10.9	10.9	10.8	9.4	10.0	10.3	8.6	8.7
Boy	12.9	11.4	11.7	11.7	9.7	10.5	11.4	9.6	9.2
Girl	10.8	10.3	10.1	9.9	9.1	9.6	9.0	7.6	8.3

Source: TURKSTAT, Vital Statistics

IMR, which was formed by showing gender discrimination, has been observed to decrease in the years except 2011, 2014 and 2015. Although the number of infant deaths has decreased in 2011, the IMR is the same as the previous year. This shows that the number of live births in 2011 is less than in 2010. In 2014, there has been an increase in both numbers and rates. This increase is due

to the increment in count of neonatal deaths. Although count of infant deaths decreased in 2015, the IMR increased. When the year 2009 was taken as the base year, IMR decreased by 26.51% in 2017. The average annual decrease is 3.47%. The male IMR is more than female IMR in the period mentioned.

3.2.2.9. West Black Sea

Table 21: Infant, Neonatal, Postneonatal Deaths in West Black Sea, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	832	689	599	625	489	577	456	452	382
Neonatal Deaths	535	449	391	424	310	402	321	283	260
Postneonatal Deaths	297	240	208	201	179	175	135	169	122

Source: TURKSTAT, Vital Statistics

In the West Black Sea Subregion, a total of 832 infant deaths occurred in 2009, while this figure decreased to 382 in 2017. In 2009, 64% of infant deaths were caused by neonatal deaths and 36% by postneonatal deaths. While the share of neonatal deaths increased to 68% in 2017, the share of postneonatal deaths decreased to 32%. When the year 2009 was taken as the base year, the number of infant deaths was decreased by 54.09% in 2017. The number of neonatal deaths was 51.40% and the number of postneonatal deaths decreased by 58.92%. Although there was a decline in general tendency of infant deaths, there was an increase in 2012 and 2014. The increment in count of infant deaths in these years is due to the increment in count of infants died in neonatal period. In general, although the number of deaths in infants has decreased, the share of neonatal deaths in deaths has increased. Table 22 shows the gender-separated IMR.

Table 22: Infant Mortality Rates by Gender in West Black Sea, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	13.0	11.2	10.2	10.7	8.5	10.1	8.3	8.4	7.3
Boy	13.9	12.0	11.4	11.3	9.3	10.5	8.6	9.0	7.7
Girl	12.0	10.4	9.0	10.0	7.7	9.7	7.9	7.9	6.8

Source: TURKSTAT, Vital Statistics

The IMR is seen to have a downward trend except for the years 2012, 2014 and 2016 in the Table 22 formed by showing gender discrimination in IMRs. Both numbers and rates increased in 2012

and 2014 and the reason of increasing is the increment in the count of neonate deaths. Despite the decline in count of infant deaths in 2016, the rate is higher than the level of previous year. When the year 2009 was taken as the base year, IMR decreased by 44.07% in 2017. The average annual decrease is 6.22%. The male IMR is more than female IMR in the period mentioned.

3.2.2.10. East Black Sea

Table 23: Infant, Neonatal, Postneonatal Deaths in East Black Sea, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	407	364	342	350	266	305	253	230	285
Neonatal Deaths	273	220	228	241	184	197	157	153	187
Postneonatal Deaths	134	144	114	109	82	108	96	77	98

Source: TURKSTAT, Vital Statistics

In the East Black Sea Subregion, a total of 407 infant deaths occurred in 2009, while this figure decreased to 285 in 2017. In the period mentioned, 66% of the deaths are caused by neonatal deaths and 34% by postneonatal deaths. When the year 2009 was taken as the base year, the count of baby deaths decreased by 29.98% in 2017. The count of neonate deaths decreased by 31.50% and the number of postneonatal deaths decreased by 26.87%. Although there was a decrease in the general trend in infant deaths, there was an increase in 2012, 2014 and 2017. Although the increase in 2012 was due to neonatal deaths, the increase in 2014 and 2017 was due to the increase in neonatal and postneonatal deaths. Table 24 shows the gender-separated IMR.

Table 24: Infant Mortality Rates by Gender in East Black Sea, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	11.4	10.6	10.4	10.7	8.2	9.3	7.9	7.2	9.1
Boy	12.8	12.0	11.9	10.6	8.2	10.3	8.4	8.5	9.3
Girl	10.1	9.2	8.8	10.8	8.2	8.3	7.3	5.8	8.9

Source: TURKSTAT, Vital Statistics

IMR is seen to have a downward trend except for the years 2012, 2014 and 2017 in the Table 24 formed by showing gender discrimination. In 2012, 2014 and 2017, there is an increase in both numbers and rates. The increase in 2012 was due to the increase in neonatal deaths, while the increase in 2014 and 2017 was caused by increasing n neonatal and postneonatal deaths. When

the year 2009 was taken as the base year, IMR decreased by 20.40% in 2017. The average annual decrease is up to 1.70%. The male IMR is more than female IMR in the period mentioned except for 2013 and 2013.

3.2.2.11. Northeast Anatolia

Table 25: Infant Mortality Rates by Gender in Northeast Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	642	695	780	663	735	650	637	573	507
Neonatal Deaths	321	372	460	400	465	381	370	322	299
Postneonatal Deaths	321	323	320	263	270	269	267	251	208

Source: TURKSTAT, Vital Statistics

In the Northeast Anatolia Subregion there were 642 infant deaths in 2009 and this number decreased to 507 in 2017. In 2009, 50% of infant deaths were caused by neonatal deaths and 50% by postneonatal deaths. While the share of neonatal deaths increased to 59% in 2017, the share of postneonatal deaths decreased to 41%. When the year 2009 was taken as the base year, the number of infant deaths was decreased by 21.03% in 2017. The count of neonate deaths was 6.85% and the count of postneonatal deaths decreased by 35.20%. Although there was a decrease in the general trend in baby deaths, there was an increment in years 2010, 2011 and 2013. The increase in these years is mainly due to the increase in neonatal deaths. The decrease rate of postneonatal deaths is higher than the decrease rate in neonatal deaths and this shows that the structure of the factors causing infant mortality has changed. In general, although the number of deaths in infants has decreased, the share of neonatal deaths in infant deaths has increased. It appears that the distribution of a suitable share to the other western regions has reached over time. Table 26 shows the gender-separated IMR.

Table 26: Infant Mortality Rates by Gender in Central Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	11.9	10.9	10.9	10.8	9.4	10.0	10.3	8.6	8.7
Boy	12.9	11.4	11.7	11.7	9.7	10.5	11.4	9.6	9.2
Girl	10.8	10.3	10.1	9.9	9.1	9.6	9.0	7.6	8.3

Source: TURKSTAT, Vital Statistics

IMR, which was formed by showing gender discrimination, has been observed to decrease in the years except 2011, 2014 and 2015. Although the count of infant deaths declined in 2011, IMR is the same as previous year. This shows that the number of live births in 2011 is less than in 2010. In 2014, there has been an increase in both numbers and rates. This increment is due to the increment in count of neonate deaths. Although count of infant deaths decreased in 2015, the IMR increased. When the year 2009 was taken as the base year, IMR decreased by 26.51% in 2017. The average annual decrease is 3.47%. The male IMR is more than female IMR in the period mentioned.

3.2.2.12. Centraleast Anatolia

Table 27: Infant Mortality Rates by Gender in Centraleast Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	1,500	1,232	1,143	1,129	1,308	1,270	1,186	1,098	1,002
Neonatal Deaths	900	704	589	621	821	808	732	688	625
Postneonatal Deaths	600	528	554	508	487	462	454	410	377

Source: TURKSTAT, Vital Statistics

While a total of 1,500 infant deaths occurred in the Centraleast Anatolia Subregion in 2009, this number decreased to 1,002 in 2017. In 2009, 60% of infant deaths were caused by neonatal deaths and 40% by postneonatal deaths. While the share of neonatal deaths increased to 62% in 2017, the share of postneonatal deaths decreased to 37%. When the year 2009 was taken as the base year, count of baby deaths decreased by 33.20% in 2017. The number of neonatal deaths decreased by 30.56% and count of postneonatal deaths declined by 37.17%. The general trend in the count of baby deaths is a decrease except for 2013. The increment in the count of infant deaths in 2013 is since increase in neonatal deaths. Table 28 shows the gender-separated IMR.

Table 28: Infant Mortality Rates by Gender in Centraleast Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	17.3	14.3	13.6	13.4	15.4	14.6	14.2	13.6	12.4
Boy	16.8	14.6	13.8	13.4	16.2	15.4	14.5	13.5	12.6
Girl	17.8	14.0	13.3	13.4	14.5	13.8	13.9	13.6	12.3

Source: TURKSTAT, Vital Statistics

It is seen that the IMR has a downward trend except for 2013 in the Table 28 formed by showing gender discrimination. In 2013, there has been an increase in both numbers and rates. When the year 2009 was taken as the base year, IMR decreased by 28.01% in 2017. The average annual decrease is 3.68%. The male IMR is more than female IMR in the period mentioned except for 2009, 2012 and 2016.

3.2.2.13. Southeast Anatolia

Table 29: Infant Mortality Rates by Gender in Southeast Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Infant Deaths	3,657	3,342	3,380	3,437	3,433	3,850	3,423	3,242	2,860
Neonatal Deaths	2,224	1,976	1,978	2,124	2,185	2,542	2,115	2,024	1,733
Postneonatal Deaths	1,432	1,366	1,402	1,313	1,248	1,308	1,308	1,218	1,127

Source: TURKSTAT, Vital Statistics

While a total of 3,657 infant deaths occurred in the Southeast Anatolia Subregion in 2009, this figure decreased to 2,860 in 2017. In the period mentioned, 61% of the deaths are caused by neonatal deaths and 39% by postneonatal deaths. When the year 2009 was taken as a base year, the count of baby deaths was decreased by 21.79% in 2017. The count of neonate deaths decreased by 22.08% and the number of postneonatal deaths by 21.30%. Decrease rates in this sub-region are close to each other compared to other eastern sub-regions. The general trend in infant deaths is reduced except for 2011, 2012 and 2014. The increment in count of baby deaths in 2011 was since increment of deaths in postneonatal period. The increase in the number of infant deaths in 2012 increased in the neonatal period. the increase in the number of infant deaths in 2014 was due to the increase in the number of infant deaths in both neonatal and postneonatal periods. Table 30 shows the gender-separated IMR.

Table 30: Infant Mortality Rates by Gender in Southeast Anatolia, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	17.5	15.8	15.8	15.6	15.5	16.4	14.8	14.4	12.6
Boy	18.3	16.4	16.3	16.0	16.1	17.7	15.5	14.7	13.1
Girl	16.6	15.0	15.4	15.1	14.8	15.1	14.1	14.1	12.1

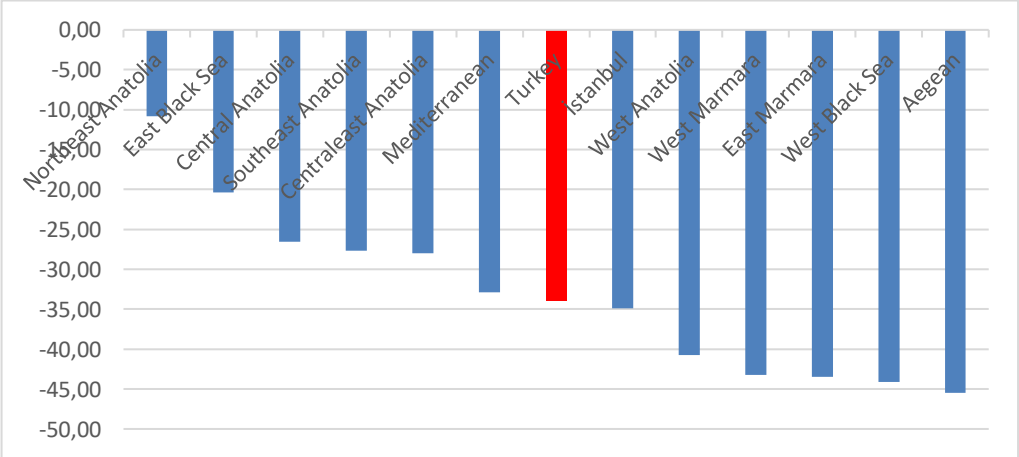
Source: TURKSTAT, Vital Statistics

It is seen that IMR has a downward tendency except 2011 and 2014 in the Table 30 formed by showing gender discrimination. While the number of infant deaths increased in 2011, there is no increase in the rate. In 2014, infant mortality was increased in both numbers and rates. When the year 2009 was taken as the base year, IMR decreased by 27.64% in 2017. The average annual decrease is 3.79%. The male IMR is more than female IMR in the period mentioned.

3.2.3. Evaluations

The share of neonatal death was higher than the share of postneonatal death in each subregion and national level between the years 2009-2017. When the structure of infant mortality in developed and developing countries is examined, it is known that the share of NMR in IMR is higher. In order to reduce the deaths in the neonatal period, high cost investments are required (Andrews et al., 2008). Therefore, reducing NMRs is a longer and more challenging process than reducing PMRs. Because of the high NMR share in Turkey's IMRs, health-based development shows that a sense of proximity to the developing countries in terms of profile. Reduction rates of IMRs are shown in Figure 3, with regional separation (SR Level 1).

Figure 3: Percentage of Reduction in Infant Mortality Rate in 2009-2017



Source: TURKSTAT, Vital Statistics

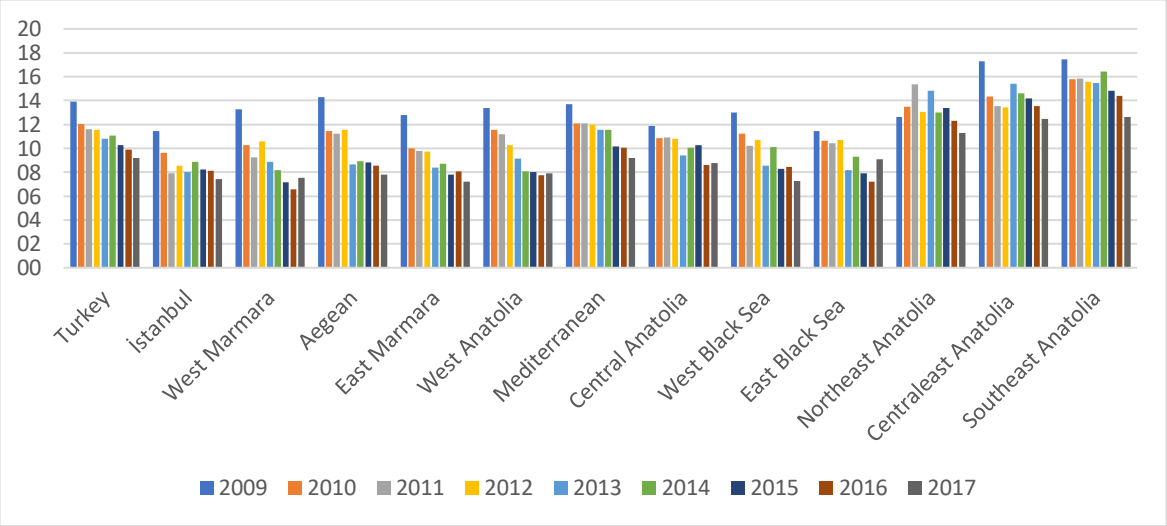
When the year 2009 was taken as a base year, IMR was decreased by 33.97% in 2017. In terms of the subregions, the region with the most decrease was Aegean region (45.46%) and the region with the lowest decrease was Northeast Anatolia (10.84%). The most decreases in IMRs were in Aegean, West Black Sea, East Marmara, West Marmara, West Anatolia and Istanbul subregions, respectively. These subregions are the developed and the developing regions of Turkey. The subregions which are average reduction rate lower than Turkey, are Mediterranean, Centraleast

Anatolia, Southeast Anatolia, Central Anatolia, East Anatolia Black Sea and Northeast subregions. These subregions are mostly lagging behind in terms of development of Turkey. From this point of view, we can say that the rate of decrease in IMRs is most in the most developed and developed regions. These regions are also places where the number of infant deaths is low. We can conclude that the underdeveloped areas have high IMRs and the lower reduction of IMRs.

The percentages of neonatal and postneonatal deaths in İstanbul, Aegean and Mediterranean sub-regions are close to each other. In West Marmara, East Marmara and West Anatolia subregions, decrease in neonatal mortality is higher than the decrease in postneonatal mortality. This shows that the decrease in neonatal deaths in developed and developed regions is seen and success is achieved. In the subregions of Central Anatolia, Northeast Anatolia and Centraleast Anatolia, the decrease in postneonatal mortality is higher than the rate of decrease in neonatal mortality. Reduction of postneonatal deaths can be achieved mostly by environmental factors and high cost investments. Postneonatal deaths at lower levels of development are known to be higher. analysis of the situation in the lower regions of Turkey in this case is also supportive.

Table 31 and Figure 4 show IMR in Turkey according to SR Level 1 in 2009-2017 period.

Figure 4: Infant Mortality Rate, SR Level 1, 2009-2017



Source: TURKSTAT, Vital Statistics

Table 31: Infant Mortality Rate, SR Level 1, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Turkey	13.9	12.0	11.6	11.6	10.8	11.1	10.2	9.9	9.2
İstanbul	11.4	9.6	7.9	8.6	8.0	8.9	8.2	8.1	7.4
West Marmara	13.3	10.3	9.2	10.6	8.9	8.2	7.1	6.6	7.5
Aegean	14.3	11.4	11.2	11.6	8.7	8.9	8.8	8.6	7.8
East Marmara	12.8	10.0	9.8	9.8	8.4	8.7	7.8	8.1	7.2
West Anatolia	13.4	11.5	11.2	10.3	9.1	8.1	8.0	7.7	7.9
Mediterranean	13.7	12.1	12.1	12.0	11.6	11.6	10.2	10.1	9.2
Central Anatolia	11.9	10.9	10.9	10.8	9.4	10.0	10.3	8.6	8.7
West Black Sea	13.0	11.2	10.2	10.7	8.5	10.1	8.3	8.4	7.3
East Black Sea	11.4	10.6	10.4	10.7	8.2	9.3	7.9	7.2	9.1
Northeast Anatolia	12.6	13.5	15.4	13.1	14.8	13.0	13.4	12.3	11.3
Centraleast Anatolia	17.3	14.3	13.6	13.4	15.4	14.6	14.2	13.6	12.4
Southeast Anatolia	17.5	15.8	15.8	15.6	15.5	16.4	14.8	14.4	12.6

Source: TURKSTAT, Vital Statistics

As shown in Figure 4 (or Table 31), IMRs tend to decrease over the years in all subregions. There was an increase or stable in IMRs in four subregions in 2011, six subregions in 2012 and eight subregions in 2014 compared to previous year. There is an increase in overall Turkey in 2012 and 2014. Table 31 also shows values of the subregions as red above the average IMR in Turkey. Northeast Anatolia has always a higher IMR than that at national level in period mentioned except for 2009. The Centraleast and Southeast Anatolia subregions have higher IMR than that at national level. The IMR in Mediterranean subregion is higher than that at national level except for 2009 and 2015. Generally, IMR in Turkey's southern and eastern regions is above average.

As a result, the process of decreasing IMRs starts with a decline in the count of deaths occurring in postneonatal period and decrease of PMRs. The situation of the reduction in the share of PMRs in IMRs requires further studies to reduce NMRs. Since NMRs involve both the effects of before and after birth process, reducing NMRs require more comprehensive and therefore more costly

investments. Thus, the share of NMRs in developed and developing countries is high in IMRs, but they are also able to further reduce IMRs.

CHAPTER 4

SOCIO-ECONOMIC FACTORS AFFECTING IMR IN TURKEY: PANEL DATA ANALYSIS

All data sets used in this section are obtained from TURKSTAT which official statistics institution of Turkey is. Time interval covered in the study, the number of observations included in the analysis, numerical analysis and inference are large to inference. The study consists of an independent variable and nineteen dependent variables to cover six years (2009-2014) for 81 provinces. Each variable contains an equal number of observations. Panel data analysis of socio-economic factors affecting IMRs will be made. For this purpose, firstly, panel data analysis, which is the econometric estimation method to be used in the analysis, is mentioned. Then, the variables and data set to be used in the analysis are presented. In addition, the findings are evaluated.

4.1. DATA SET, METHOD AND MODEL

In econometric studies, it is seen that generally cross sectional or time series data are used. Time series studies focus on time dimension and cross section size is taken into consideration in cross-sectional studies. However, since the 2000s, the popularity of panel data studies has started to increase. In panel data studies both time dimension and section size are taken into consideration together.

Panel data usage in econometric analyzes brings significant advantages over other types of data. It is possible to sort these advantages as follows (Baltagi, 2005; Hsiao, 2014).

i. Panel data sets contain the information that the sections it covers are heterogeneous; thus, the data set is controlled against heterogeneity.
ii. Since panel data analysis has more variable than time series and cross-sectional data analysis, multicollinearity is less frequently encountered in these data. Furthermore, because of the relatively large number of observations, the degree of freedom is higher in the models estimated by the panel data.
iii. The panel data reflects the dynamics of change in analyzes such as evaluating the effects of economic policies implemented for a period.
iv. Panel data allow analysis to be performed in the presence of short time series or inadequate section observation.

v. Panel data increases the efficiency of economic estimators.

vi. "Panel data analysis provides more accurate, realistic and comprehensive forecasts for each result. In addition to all these advantages of this analysis, the biggest and most important contribution of this analysis is the measurement of the effects of the factors which cannot be measured and cannot be observed".

The fact that the panel data set contains an equal length time series for each horizontal section is called a balanced panel. When the time series lengths change from horizontal to horizontal section, it is called as unbalanced panel. In this study, there is a balanced panel condition.

The panel data model is expressed as in equation (4.1).

$$Y_{it} = \beta_{1it} + \beta_{2it}X_{2it} + \beta_{3it}X_{3it} + \ldots + \beta_{kit}X_{kit} + u_{it} \quad (4.1)$$

$i = 1,\ldots,N \quad t = 1,\ldots,T \quad \text{and} \quad k = 1,\ldots,K$

Here, N denotes the cross-sectional units, "T denotes time" and "K denotes the number of explanatory variables". According to this:

Y_{it} : The value of dependent variable of cross sectional units of "i" in time "t".

X_{kit} : The value of explanatory variable "k" of cross sectional units of "i" in time "t".

β_{kit} : The estimated coefficient of explanatory variable "k" for unit "i" and time "t"

u_{it} : Error term which has zero mean and constant variance.

In the case of time series, the conditions of N = 1 and T> 1 are valid, while in the case of cross section there is T = 1 and N> 1. However, the conditions of N> 1 and T> 1 apply in the panel data analysis (Johnston & DiNardo, 1997).

The coefficients take different values for different units in different time periods. The number of parameters to be estimated under these conditions exceeds the number of observations used, so the model cannot be estimated. For this reason, different models can be obtained depending on the assumptions about the constant, slope coefficient and error term in panel data studies.

The first of these models is the pooled model. In this model, the section and time dimensions of pooled data are ignored. In other words, all independent variables in this model affect the cross-sectional units equally.

The fixed effects model, in which the slope coefficients are the same for time and section units but the constant coefficient changes according to the cross-sectional units, is another panel data model (Hsiao, 2014). In this model, the differences between the cross-sectional units are

explained by the differences in the constant term. Considering equation (4.1), in fixed effects model

It is assumed that $\beta_{2it} = \beta_2$, $\beta_{3it} = \beta_3$ So, the equation is

$$Y_{it} = \beta_{1i} + \beta_{2i}X_{2it} + \beta_{3i}X_{3it} + \ldots + \beta_{ki}X_{kit} + u_{it} \quad (4.2)$$

In studies conducted with panel data, the fixed effects model is used, and the random effects model is also used. “In random effects model, it is assumed that the differences in the cross-sectional units are random as the error term” (Hsiao, 2014). “In these models, changes to the cross-sectional units or units and time are included in the model as a component of the error term. The most important reason for this is the prevention of loss of degree of freedom encountered in the fixed effects model” (Baltagi, 2005).

Socio-economic factors affecting IMR in Turkey will be examined by using panel data analysis for 2009-2014 period because of the advantages of panel data analysis with the higher number of observations and the fact that the effects of the non-measurable factors can be measured compared to the time series and the cross section.

It is essential to refer to the data set, variables, the basic theoretical framework and the model to be used in the analysis before moving on to the panel data analysis estimates and results.

The panel data model described above is adapted to the function created for IMRs;

$$IMR_{it} = \beta_{1it} + \beta_{2it}X_{2it} + \beta_{3it}X_{3it} + \ldots + \beta_{kit}X_{kit} + u_{it} \quad (4.3)$$

The equation is obtained. While the independent variables are the factors that affect IMR, the dependent variable. The estimation of the model (5.3) is examined for 81 provinces in Turkey. The reason for the participation of data set of 81 provinces in the analysis is to increase the number of observations. The period subject to the study covers the years 2009-2014. Therefore, panel data analysis was performed for a total of 6 years (T = 6) between 2009-2014. 81 provinces in Turkey is identified cross section units (N = 81).

It is necessary to present the expectations regarding the coefficient signs of variables used in model according to results for variables used in the second chapter which is studies in literature review. A total of twelve different variables are used, one dependent and eleven independent variables.

4.2. VARIABLE CONSTRUCTION AND DEFINITIONS

4.2.1 Dependent Variable

Infant Mortality Rate (IMR): IMR was used as a single dependent variable in the model. IMR is the number of infant deaths per thousand live births in current year. IMRs as a health indicator indicate the level of development of a country. As the IMR decreases, the level of health and development is increasing.

4.2.2 Independent Variables

The independent variables are divided into four categories according to the socio-economic framework. These are economic, age and fertility, health supply and education factors. The definitions of variables used in panel data analysis are given below.

4.2.2.1 Economic Factors

There are three different variables within economic factors. These are real gross domestic product per capita (INCOME), unemployment rate (UNEMP), external terms of trade (EXIM).

Real GDP per capita (INCOME): At provincial level, the real gross domestic product per capita in TL was obtained by comparing GDP per capita to the consumer price index (CPI) values which is prepared according to SR Level 2. The logarithm of the values was taken. Revenue may have a direct or indirect impact on the IMR. It is expected that income will have a reducing effect on IMR.

Unemployment Rate (UNEMP): It is prepared to SR Level 2. Unemployment rates at regional basis were used for each province. The rates are in the form of percentages. Unemployment rates are important factor among economic factors. Unemployment rates are expected to be a factor increasing the IMR.

External Terms of Trade Rate (EXIM): The ratio of export values to import values has been taken according to prepared in SR Level 3. The ratio of exports to imports gives external terms of trade rate (EXIM). EXIM are considered to be an important variable in explaining IMRs in terms of the fact that the province has gained an industrialized and free market situation. If the external terms of trade rate exceed 100, the value obtained from exports exceeds the value we lost -foreign

trade surplus. If this ratio is below 100, then a framework related to imports will be higher than export -foreign trade deficit. It is expected that the external terms of trade rate exceed 100, that the province has high in production, unemployment may be low, and it may reduce the IMR as an economic factor in terms of value added.

4.2.2.2 Size and Age Factors

There are four different variables in age and fertility factors. These are average size of household (SIZEHH), average age at marriage for female (FEMAVG), the rate of female married for the first time between the ages 45-49 (FEM4549), and mean age at first marriage for male (MALEMEAN).

Average Size of Household (SIZEHH): It is the average number of persons in a household. It is the ratio of total household population to total number of households. Data set is prepared according to SR Level 3. Although the effect of the average size of households is not clear, the coefficient signal can be in both directions. The increase in the count of people in household can make livelihood difficult. Costs may not be covered. It is inferred that living standards fall. In this respect, the increase in the number of people in the household can increase the IMR. In another aspect, living with parents in the same household can provide parents with more awareness of infant care. In addition, parents can help the mother in the care of the newborn infant. Therefore, it can be a factor that decreases the IMR.

Average Age at Marriage for Female (FEMAVG): It is the average age at marriage of female getting married in a given year. The data set is prepared according to SR Level 3. As the average age of women in marriage increases, the IMR is expected to decrease. It is assumed that the education, experience and knowledge levels of the individuals who married are higher as the average age of marriage increases. It is known that marriage at a very late age is a factor that increases the IMR. The ratio of the first marriage of women between the ages of 45-49 in the period 2009-2014 to the total number of first married women is 0.34%. Due to the low number of first marriages in late ages, this variable is not expected to change the effect of IMR.

The Rate of Female Married for the First Time Between the Ages 45-49 (FEM4549): The data set was prepared by taking the ratio of the count of women married in 45-49 age group to the total number of women in 45-49 age group. Data set is prepared according to SR Level 3. It is expected that the marriage rates over the age of 45 are risky for fertility, and the increase in marriage rates in late ages will be a factor that increases the IMR.

Mean Age at First Marriage for Male (MALEMEAN): It is the mean age of men when they get married for the first time in a given year. The data set is prepared according to SR Level 3. In men, it is expected that the average age of marriage in the first marriage will decrease the IMR.

4.2.2.3 Health Supply Factors

There are three different variables within the health supply factors. These are number of persons per physicians (PHYSICIAN), number of persons per nurses (NURSE), number of persons per midwifes (MIDWIFE).

Number of Persons per Physicians (PHYSICIAN): It gives the number of people per physician. The data set is prepared according to SR Level 3.

Number of Persons per Nurses (NURSE): It gives the number of people per nurses. The data set is prepared according to SR Level 3.

Number of Persons per Midwifes (MIDWIFE): It gives the number of people per midwifes. The data set is prepared according to SR Level 3.

The signs of health supply factors on IMR are expected to be positive.

4.2.2.4 Education Factor

Net schooling rates in secondary education for girls (GIRLSCHOOL) is an only variable in education factor.

Net Schooling Rates in Secondary Education for Girls (GIRLSCHOOL): It represents the enrollment rates of male students in secondary education. The data set is prepared according to Level 3 SR. The effect of this variable on the IMR is expected to be negative.

TURKSTAT database was used in the data set. The data determined by SR Level 2 are adapted to SR Level 3. Since data are required to be used for each province in the panel data analysis, the appropriate data set is available only in TURKSTAT. Data sets which were formed according to statistical regions were scanned and variables that could be suitable for IMRs were compiled. The data sets which are not suitable for analysis are adapted to the analysis as much as possible.

4.3 PANEL DATA ANALYSIS

As mentioned earlier in the panel data method, different models can be obtained depending on the assumptions about constant, slope coefficient and error term. In this subsection model, fixed effects model and random effects model will be used for this model and it will be decided which model will be used with Hausman test. StataMP 14 econometrics package program will be used for the related estimations and tests. The results of the StataMP 14 output will be presented in tabular form.

4.3.1 Model

$$IMR_{it} = \beta_1 + \beta_2(INCOME)_{it} + \beta_3(UNEMP)_{it} + \beta_4(EXIM)_{it} + \beta_5(SIZEHH)_{it} + \beta_6(FEMAVG)_{it} + \beta_7(FEM4549)_{it} + \beta_8(MALEMEAN)_{it} + \beta_9(PHYSICIAN)_{it} + \beta_{10}(NURSE)_{it} + \beta_{11}(MIDWIFE)_{it} + \beta_{12}(GIRLSCHOOL)_{it} + u_{it} \quad (4.4)$$

The estimation results are presented in Table 32

Table 32: Fixed and Random Effects of Variables on Infant Mortality Rate

Variables	Fixed Effects Regression		Random Effects Regression	
	Coefficients	Std. Err.	Coefficients	Std. Err.
INCOME	0.35349	0.6386	-0.12415	0.5539
UNEMP	0.07936*	0.0414	0.14636***	0.0358
EXIM	0.00002	0.0000	0.00002	0.0000
SIZEHH	-3.2436***	1.1696	0.15628	0.3598
FEMAVG	-0.76936**	0.3533	-0.60891	0.2390
FEM4549	667.796**	326.7536	780.925***	286.577
MALEMEAN	-2.3161***	0.6432	-0.79543***	0.3021
PHYSICIAN	0.00284*	0.0017	0.00003	0.0011
NURSE	0.00288	0.0018	0.00055	0.0013
MIDWIFE	-0.0026***	0.0008	-0.00075	0.0005
GIRLSCHOOL	-0.07712**	0.0341	-0.03858*	0.0208
CONSTANT	106.7274	14.9677	49.626	7.1023
R^2	0.84		0.40	
Adjusted R^2	0.84			

Notes: 1) *** p<0.01, **p<0.05, *p<0.1
2) Number of observations: 484

Hausman test was conducted to determine which was the statistically valid relationship between fixed effect regression and random effect regression. In Hausman Test, null hypothesis assumes that the random effect regression model is valid. The alternative hypothesis assumes that the fixed effect regression model is valid. As a result of Hausman test, Chi Square value was 36.38. The null hypothesis is rejected because Prob= 0.000 < 0.05. As a result, there is a fixed effect.

In order to express the effects of province-specific conditions on IMRs, the fixed effects model will be estimated in which the constant coefficient changes according to the cross sectional units. In this model, the homogenous structure hypothesis among provinces is rejected and the effects specific to the provinces are reflected in the results.

The R^2 value (0.84) indicates that the independent variables included in the model explain a significant portion of the IMR.

Only the unemployment rate in the group of economic factors has a statistically significant effect. Unemployment rates increase IMRs.

In group of size and age factors, all variables were statistically significant. The average size of household, the average age of women in marriage, the average age of men in the first marriage are significant variables that reduce IMR. The ratio of the women who married for the first time between the ages 45-49 to the total number of women in that age group appears to be a factor increasing the IMR.

Number of persons per physicians and midwifes were statistically significant among health supply factors. The number of persons per physicians increases the IMR while the number of persons per midwifes decreases the IMR.

The schooling rate of girls in secondary education have a statistically significant effect on IMR. IMRs decrease as girls' participation in secondary education increases.

4.3.2. Descriptive Statistics

The descriptive statistics for the variables are presented in Table 33. The table shows the variation of variables over time. The variables were analyzed based on the data of 81 provinces. No regional distinction was made.

The GDP per capita variable is shown in currency of Turkish Lira. The amounts reflect current income. From 2009 to 2014, per capita income has nearly doubled. The same statement can be said for the minimum and maximum values.

Unemployment rate was on a downward trend and it increased in 2013 and 2014. It can be concluded that there was not fair distribution of income because of increasing unemployment rates with increasing income in the last two years of the analysis period.

The fluctuation in the external terms of trade rate is high. After the world economic crisis in 2009, it is observed that the external terms of trade rate had extremely decreased.

Average size of household decreased during the analysis period. The fact that married couples have fewer children than in the past and that they move to another house after marriage reduces household size. However, the average age of women in marriage is also increasing. Marriages are held at a later age. The proportion of women who have married for the first time between the ages of 45-49 fluctuates. It has a very small proportion in the total number of marriages. The average age of men in their first marriage increases over the years. The average age of men in their first marriage increases over the years. The first marriage age of men has increased by half a year in the analysis period. The average age at first marriage for men is higher than the average age at marriage for women. This shows that women get married at a younger age than men.

The number of people per physician has decreased continuously except for 2014. The number of people per nurse is also decreasing. It is seen that the number of physicians and nurses has been increasing more than the previous years. While the number of people per midwife fluctuated in the first years during the analysis period, it increased gradually towards the last years. The values of 2014 and 2019 were almost equal. The average number of midwives is much less than the number of physicians and nurses.

The net schooling rates of girls in secondary education increased gradually during the analysis period. Minimum value in 2009 was half of the minimum value in 2014.

Table 33: Descriptive Statistics for Variables, 2009-2014

	2009	2010	2011	2012	2013	2014
GDP per capita (TL) (Mean)	10411.7	12133.7	14296.4	15970.7	18056.6	20124.1
(Std. Dev.)	(3873.4)	(4234.8)	(5117.9)	(5539.0)	(6351.3)	(7075.0)
(Min.)	4210.1	5678.2	6111.2	7083.0	7828.5	8485.7
(Max.)	23454.1	26253.3	31164.9	34637.3	39467.9	43645.1
Unemployment Rate (%) (Mean)	12.7	10.7	9.0	8.4	8.7	8.9
(Std. Dev.)	(4.07)	(2.9)	(2.7)	(3.5)	(3.7)	(4.7)
(Min.)	6.0	6.1	4.7	4.3	4.6	3.4
(Max.)	21.9	17	14.7	21.3	20.9	24
External Terms of Trade (Mean)	1336.7	368.1	347.7	480.1	251.5	1011.7
(Std. Dev.)	(7592.9)	(871.1)	(1077.7)	(2143.0)	(313.4)	(6807.7)
(Min.)	6.3	5.2	8.5	5.3	0.3	9.9
(Max.)	67880.4	6588.2	9257.5	19083.7	1486.8	61457.7
Average Size of Household (Mean)	4.3	4.1	4.0	3.9	3.8	3.7
(Std. Dev.)	(1.2)	(1.2)	(1.2)	(1.1)	(1.0)	(1.0)
(Min.)	2.9	2.8	2.7	2.7	2.7	2.6
(Max.)	8.4	8.3	8.1	7.8	7.6	7.3
Average Age at Marriage for Female (Mean)	24.3	24.4	24.6	24.9	24.9	25.1
(Std. Dev.)	(1.2)	(1.1)	(1.2)	(1.2)	(1.3)	(1.3)
(Min.)	22.2	21.9	22.1	22.1	22.1	22.1
(Max.)	29.7	26.7	27.1	27.3	28.2	28.1
The Rate of Female Married for the First Time Between the Ages 45-49 (Mean)	0.00078	0.00072	0.00088	0.00090	0.00078	0.00085
(Std. Dev.)	(0.0005)	(0.0004)	(0.0006)	(0.0005)	(0.0004)	(0.0005)
(Min.)	0	0	0	0	0	0.00016
(Max.)	0.0026	0.0022	0.0048	0.0025	0.0024	0.0038
Mean Age at First Marriage for Male (Mean)	26.5	26.6	26.7	26.8	26.9	27.0
(Std. Dev.)	(0.83)	(0.84)	(0.79)	(0.82)	(0.88)	(0.88)
(Min.)	24.9	25.0	25.2	25.2	25.4	25.5
(Max.)	28.8	29.0	28.7	29.1	29.6	29.7
Number of Persons per Physicians (Mean)	846.3	765.0	733.5	734.8	725.0	736.9
(Std. Dev.)	(246.2)	(181.6)	(171.1)	(188.07)	(189.6)	(212.3)
(Min.)	267.8	287.7	326.5	325.3	312.7	319.6
(Max.)	1469.0	1126.8	1105.6	1191.4	1161.8	1381.4
Number of Persons per Nurses (Mean)	745.3	720.3	625.1	579.3	561.8	556.6
(Std. Dev.)	(187.4)	(190.7)	(162.7)	(148.3)	(134.1)	(140.7)
(Min.)	434.9	310.6	315.9	318.7	316.4	315.3
(Max.)	1316.2	1356.8	1180.4	1093.1	1005.5	1018.6
Number of Persons per Midwifes (Mean)	1364.2	1337.0	1350.5	1296.1	1311.3	1360.8
(Std. Dev.)	(396.3)	(363.7)	(384.3)	(494.3)	(492.8)	(526.5)
(Min.)	515.9	482.3	534.9	529.3	569.5	561.8
(Max.)	2683.9	2442.5	2510.4	3255.6	2874.1	3114.4
Net Schooling Rates in Secondary Education for Girls (%) (Mean)	55.86	61.73	63.87	66.80	70.16	76.77
(Std. Dev.)	(17.06)	(17.16)	(16.65)	(16.20)	(15.28)	(13.75)
(Min.)	15.94	20.04	22.96	22.65	30.59	36.47
(Max.)	82.36	88.18	89.02	90.14	91.08	97.98

4.3.3. Multicollinearity

Multicollinearity occurs when there is a highly linear relationship between independent variables. In the presence of this problem, the standard errors, variances and common variances of the independent variables are very large and therefore the confidence intervals are very wide. Because of this result, t ratios of one or more coefficients become statistically insignificant (Gujarati & Porter, 1999).

Variance inflation factor (VIF) was examined by using StataMP program in order to determine whether the model has multicollinearity. "As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation. Tolerance, defined as 1/VIF, is used to check on the degree of collinearity. A tolerance value lower than 0.1 is comparable to a VIF of 10. It means that the variable could be considered as a linear combination of other independent variables" (UCLA Institute for Digital Research and Education, 2019).

Table 34 shows the VIF for independent variables. The VIF of any variable did not exceed 10. Tolerance values are not below 0.1.

Table 34: Variance Inflation Factor for Independent Variables

Variables	VIF	Tolerance
SIZEHH	7.56	0.132
GIRLSCHOOL	6.87	0.145
FEMAVG	4.25	0.235
INCOME	3.77	0.265
NURSE	3.54	0.282
MIDWIFE	3.21	0.311
PHYSICIAN	2.35	0.424
MALEMEAN	2.29	0.436
UNEMP	1.66	0.600
FEM4549	1.50	0.668
EXIM	1.05	0.953

4.3.4. Results and Evaluations

The aim of this analysis is demonstrating the effects of variables such as economic factors, size and age factors, health supply factors and educational factor which are supposed to be affect IMR by using data of 81 provinces in Turkey for 2009-2014. In this analysis, it was accepted that the estimated results of the fixed effects model could be consistent.

When the literature is examined, it is seen that the factors affecting IMR differ for various reasons. Infant mortality has a structure that includes all factors related to economic, social, cultural, environmental, technological and health capacity.

In economic factors, the unemployment rate was only a significant variable in influencing the IMR. While it is thought that income affects IMR as a reducing factor, there is no statistically significant result in the analysis. Income includes many factors that affect the IMR, but it is not the single most important factor. In some studies[7], it has been stated that education, health coverage, social work practices, fair distribution of income, and public policies are more important than income in decreasing IMRs. Unemployment rate as expected increases the IMR. Unemployment can be associated to the lack of income and poverty. One of the factors affecting poverty is the fact that income is not evenly distributed. In the study conducted by Tavares (2017) for EU countries, unemployment rates do not affect infant mortality in statistical significance. This is since in EU countries people have easy access to health services and social state understanding is developed. In addition, there may be little difference between the urban and the rural areas in terms of sharing services. As a result, unemployment, and thus poverty and income inequality in terms of impact on IMRs seem to be more important than income.

The external terms of trade rate do not significantly affect IMR. The increase in the external terms of trade rate is considered as a variable that increases the capital infrastructure of the provinces. It is assumed that more production can be done in the provinces where the amount of export is higher, more production is more business opportunity and hence also increases the income. Shandra et al. (2004) stated that some socio-economic factors that affect exports and international companies have decreased the IMR. In the eastern and southeastern provinces, the external terms of trade rates are high. Besides, these provinces constitute the group of underdeveloped provinces in terms of level of development of Turkey. Therefore, the external terms of trade rate have become an insignificant variable to reduce IMR.

The average size of household appears to be a prominent factor in the reduction of infant mortality. Large families have an important place in a strong and traditional society of family ties. Household size can have two kinds of effects in decreasing infant mortality. Firstly, the parents living with their parents benefit from the experience and assistance of the elderly population in the care of newborn infant. On the other hand, couples who do not live with their own parents have experience when they have a infant. They use this experience gained from the first child in the second and subsequent deliveries in the subsequent birth stages. Therefore, the increase in the

[7] Mosk & Johansson (1986); Burgess, Propper, & Rigg (2004); Andrews et al. (2008); Tüylüoğlu & Tekin (2009)

size of the household can be explained by the influence of the experience factor in reducing infant mortality.

Age factors constitute the most important factor group in terms of their effect on infant mortality. The average age of women in marriage seems to be an important variable in this sense. As the average age of women in marriage increases, the IMR decreases. This shows that women are more conscious in the middle age and can be more educated in infant care. At the same time, women in middle age are more likely to have economic freedom. Marriage at a late age is important, especially in terms of women regulating their own education and working life. The rate of women who marry for the first time in the 45-49 age group seems to be a factor that increases infant mortality. The 45-49 age range is a fairly late age range for a healthy birth. In the literature, it is stated that mothers who are older than 40 years of age are more than twice the death of infants compared to the age of 20 years (Andrews et al., 2008). In the first marriage, the average age of males is one of the variables that decreases the IMR. Late marriage has a positive effect for men too in terms of IMRs. In some studies[8] in the literature, it was reported that the mothers who were young were more often encountered with infant mortality.

The number of people per doctor and midwife appear to be significant variables among the health supply factors. As expected, the increase in the number of people per doctor increases the IMR statistically significantly. On the other hand, as the number of people per midwife increases, IMR decreases. It is thought that the disability in accessing health services in urban and rural regions may be influenced by the fact that the two health supply variables give opposite results. The possibility that the collected data could not be taken regularly and correctly, the decrease trend in IMRs and the increase in the number of people per midwife may have caused this variable to be negative sign. Younger (2001) stated that the number of hospital beds per a thousand people, the number of persons per doctor and nurse did not have the effect of reducing infant mortality. This was due to the fact that the variables were mostly measured in urban areas. In literature, a study shows that the number of infants per pediatrician, doctor and midwife are set to increase IMR in Turkey (Dilli et al., 2016). It is thought that factors such as the number of obstetricians who may be directly related to infant birth will be a significant factor that decreases infant mortality.

The net schooling rate for girls was found to have significant effect on IMR. The increment in the number of girls participating in secondary education is a factor that decreases the IMR in statistical significance. Education of women is considered as the most important factor in decreasing IMR. There are studies[9] in the literature. The role of women in infant and child care is

[8] Geronimus (1986); Maitra (2004); Bhalotra & Van Soest (2008)
[9] Maitra (2004); Andrews et al. (2008)

more important than men. Especially in prenatal care, the fact that the education of women is important. The education of women in the demand of health services has a stronger effect than the education of men. The fact that educated women get married and have children at later ages is one of the factors that reduces infant mortality.

CONCLUSION

Development includes many economic, social and environmental factors. The health factor also has an important place in this development. Infant mortality is an indicator of development because of that many of these factors affect infant mortality. The reduction of infant mortality in the process is visible throughout the world. Developmental differences between countries have different effects on the reduction of IMRs. Within the framework of these effects, the timing of infant mortality also varies. The differentiation between the neonatal and postneonatal periods also reflects the level of development of the countries. In this context, as one of the objectives of this study is to show where it stands in the mentioned profile of infant mortality in Turkey. Besides, it shows the socio-economic factors affecting infant mortality and the relative effects of these factors.

A few mortality rates are used as criteria within the SDGs. Maternal mortality ratio, U5MR, and NMR were constituted as development criteria. IMRs account for a large proportion of U5MRs, while at the same time having NMRs.

In the historical process, the importance of infant mortality is considered to be important within the scope of the thesis. Therefore, the second part of the thesis describes infant mortality and health activities related to infant mortality in the historical process. In the early years of the Republic, the difference between infant and child mortality remained unclear. Turkey's main problem was low population in that year. Therefore, infant / child mortality was one of the main sources of the problem. The biggest obstacle to population growth was the presence of diseases. In the literature section of this study, the effect of infectious diseases on infant mortality was given. Awareness-raising activities through congresses to reduce epidemic diseases, incentive programs to increase birth rates, social service activities of various institutions, vaccination programs have played a major role in reducing infant mortality. Studies on determination of IMRs were made in first years of the Republic and it was stated that the IMR was 50-55%.

NTMCs have a great importance in reducing infant mortality. During the congresses held in 1925-1930, decisions were taken to actively prevent child mortality and epidemic diseases. In 1930-1939 period, new treatment institutions and nutritional deficiencies were conducted. In the period of 1940-1950, although there were problems in services, legislative arrangements were made. In the 1950-1960 period, Maternal and Child Health centers and branches were established for the prevention of diseases and early diagnosis. Public health came to the fore in the 1960s and became widespread in health services. According to The World Bank Database, the level of infant mortality in Turkey remained high until the mid-2000s by the economic level. IMR was 150 ‰

in the mid-1960s; 110 ‰ in the 1970s, 73 ‰ in the 1980s. It decreased to 44 ‰ in 1990s. In 2000s, IMR began to decrease more rapidly. It has fallen to 10 ‰ in 2017.

It has been achieved 33.97% reduction in IMR in Turkey for 2009-2017 period. Examination of the IMR by statistical regions provides a better understanding of the differences between regions. The share of neonatal deaths in IMRs in each subregion is greater than the share of postneonatal deaths. Although rates may vary according to subregions, 65% of IMRs at national level are neonatal mortality and 35% are postneonatal mortality. When structures of IMR of developed countries are examined, neonatal deaths occur more than postneonatal deaths. Reduction of neonatal deaths requires high cost and investment compared to postneonatal deaths.

The region that provides the most decrease in IMRs is the Aegean subregion (45.46% reduction) in the period 2009-2017. The region with the least reduction was the Northeast Anatolia subregion (10.84% reduction). The reduction in the IMRs for central and eastern regions was less than that of western regions in Turkey. Western regions provided most decline although they have less IMR compared to average IMR in Turkey. The IMR in central and eastern subregions is higher than the average in Turkey, but they remained lower than the average reduction amount. Subregions where most of the reduction achieved in IMR, was still occur in the developed subregions of Turkey. It can be said that the differentiation between the western regions and the eastern regions originates from demographic, social and economic factors.

The effects of economic, size and age, health and education factors on IMRs were measured. In economic factors, unemployment rates are a factor that increases IMRs. IMRs are also adversely affected by the fact that unemployment leads to the failure of people to reach adequate facilities, to not accessing basic food resources and to not allocating an adequate share of health expenditures. The unemployment factor is more effective, especially where there is no comprehensive health system. Factors such as unemployment and poverty are important factors affecting IMRs. With public policies, minimizing poverty, creating business potential, and producing policies that provide livelihood for people are important for their effect on IMRs.

Average size of households also appears to be a factor that reduces IMRs. The high average count of people in the household can mean the high number of people who will help the mother. Among the ones who can help the mother during the mother's infant care process, having her own parents shows that there are more experienced people in childcare. The experience factor is of great importance in the development and care of the infant.

Marriages in the middle age have a positive effect on the delivery and care of infants. Women in middle-age marriages have completed their education and have entered working life. They are

more knowledgeable and self-invested than young marriages. They also have a biological structure that is suitable for birth. Besides, the ratio of women who married for the first time in the 45-49 age group is a factor that increases the IMR. Factors such as the fact that the mother is biologically born out of fertility and cannot allocate the necessary energy and time for infant care, can be an effect that increases IMR. The average age of men in the first marriage is a factor that decreases IMR. As the average age increases for men, experience and knowledge is increasing. Factors that are more regular in life, more controlled use of time and access to sufficient economic power for family care are more common in middle-to-late ages. Age factors are known to be the relationship, the first marriages to be done in the middle age, the risk factors for both men and women are minimized by trying to have a child are important in reducing IMRs.

In terms of health services and supply, the number of people per physician that increased IMR and the number of people per midwife that decreased IMR were significant variables. The medical factor has an important role in the survival of a newborn in terms of determining the health of the infant. It is an important health supply factor that affects infant health in both neonatal and postneonatal periods. The fact that the increase in the number of people per midwife decreases the IMR may be due to unfair differences in access to health services between urban and rural areas. The decline in the number of midwives in recent years and the decrease in midwifery schools may have led to a negative trend in the number of people per midwife variable with the decreasing trend of IMRs. The number of people per nurse was also included in the model, but this variable was not statistically significant. More specific areas associated with birth and care are thought to reduce infant mortality. Therefore, it is important to emphasize the importance training of infant specialists, effective functioning of maternal and child health centers for decreasing IMRs.

Education is an important factor in the delivery and care of the infant. The knowledge of the mother about before, during and after the infant's birth, can be a factor that decreases IMRs. Having a knowledge about infant care after birth, constitutes a factor that decreases mortality for neonatal and postneonatal periods. It is seen that the mother who has direct contact with the infant, has more experience and knowledge on these subjects than the father has. In this study, the net schooling rate of girls is an important factor in decreasing IMR. Besides, the net schooling rate of girls is also important for the prevention of pregnancy at an early age. Women's participation in education should be encouraged because of the effect of women to infant care is known. Women's education is an effective factor in benefiting from health services. The importance of prenatal care services for neonatal infant health makes education of woman more meaningful. In

addition, women's education is also important for the nutrition of infant. Educated women are more likely to breastfeed because they are more aware of the importance of breastfeeding.

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APPENDIX 1. ETHICS COMMISSION FORM

HACETTEPE UNIVERSITY
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My thesis work related to the title above:

1. Does not perform experimentation on animals or people.
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I declare, I have carefully read Hacettepe University's Ethics Regulations and the Commission's Guidelines, and in order to proceed with my thesis according to these regulations I do not have to get permission from the Ethics Board/Commission for anything; in any infringement of the regulations I accept all legal responsibility and I declare that all the information I have provided is true.

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Date and Signature

Name Surname: SEMİH YILMAZ — 24.06.2019
Student No: N14225928
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Status: ☒ MA ☐ Ph.D. ☐ Combined MA/ Ph.D.

ADVISER COMMENTS AND APPROVAL

Doç. Dr. Dilek Baros
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APPENDIX 2. THESIS ORIGINALITY REPORT

HACETTEPE UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
MASTER'S THESIS ORIGINALITY REPORT

HACETTEPE UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
ECONOMICS DEPARTMENT

Date: 24/06/2019

Thesis Title : FACTORS AFFECTING INFANT MORTALITY RATES IN TURKEY: A GEOGRAPHICAL REGION ANALYSIS

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