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THE EFFECT OF TRANSPORTATION FACILITIES ON MATERNAL MORTALITY: THE GUEST MOTHERHOOD PROJECT (GMP) IN TURKEY

Summary. In undeveloped and developing countries, maternal mortality is an important problem in public health. High maternal deaths observed in some regions of Turkey are related to inequities in reaching health services (low transport facilities). To prevent maternal mortality, pregnant women should have access to health services for professional care before, during, and after childbirth. In Turkey, most maternal deaths are related to socio-economic factors, equity issues, health services and transportation facilities. Especially, transportation facilities to health centers play an important role in preventing maternal deaths. Thus, to prevent the negative effect of the winter season and adverse transportation facilities on maternal mortality, the Turkey Ministry of Health (MoH), aiming to reduce the maternal mortality ratio (MMR) in rural areas, initiated the “Guest Motherhood Project (GMP)” to cover all of its urban and rural areas. In this project, health services for pregnant women in risky regions were restructured. In the scope of the project, access problems to health centers were eliminated and rapid access to rural areas and challenging territories of Turkey were provided. Current maternal mortality statistics show that GMP is yielding good results and high quality delivery services at all health centers in every region of the country despite the regional disparities.

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1. INTRODUCTION

Maternal Mortality is described by [1] as "The death of a woman who is pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes". In undeveloped and developing countries, maternal mortality is an important problem in public health. Improving maternal health and reducing maternal deaths are some of the most important universal priorities of health centers [2]. The World Health Organization (WHO) stated that there were 303,000 maternal deaths in the world in 2015, [3]. This implies that almost 830 women die in a day from pregnancy-related reasons. Almost 99% (302,000) of the total maternal deaths were observed in undeveloped and developing countries. More than 50% and approximately 33% of these deaths occurred in Sub-Saharan Africa and South Asia, respectively [3].

Maternal mortality ratio (MMR) is one of the most important indicators of development in healthcare systems and economies of countries [4]. It is the best indicator for comparison between countries or regions over time [5]. [6] defines MMR as "The number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births". According to the 2015 statistics, this ratio was estimated at 239 per 100,000 live births versus 12 per 100,000 live births in developed countries [2]. [7] mentioned that "low coverage by health services and the lack of registries in low-and intermediate-income countries" are a huge barrier to determining and evaluating the real effects on maternal mortality in many countries. Some researchers reported that there are several factors in maternal mortality, such as maternal health, insufficient access to health care, the lack of health services, delay in health service, socio-economic conditions, etc. [8]. On the other hand, [9] notes that certain complications are seen in almost 75% of all maternal mortalities:

- Vigorous bleeding (mostly after childbirth),
- Infections (usually after childbirth),
- High blood pressure during pregnancy (pre-eclampsia and eclampsia),
- Delivery Complications,
- Unsafe abortion.

Previous research and statistics show that MMR has higher values in rural areas, especially in developing countries. There are huge health care facility disparities between [2]:

- Countries,
- Women who have high and low incomes,
- Women who live in rural versus urban areas.

According to [10] health statistics, the largest gap between developed and developing nations is observed in maternal mortality levels [11]. To prevent these inequality and maternal deaths, it is extremely important to improve health facilities in undeveloped countries, especially in rural areas [12]. The high maternal deaths in some regions are related to inequities in reaching health services (low transport facilities) and show the difference between developed and developing countries [2]. Some of these maternal mortalities can be prevented by taking some precautions, such as health care solutions, etc. But poor women in far regions have less

probability to take necessary health care. Also, this issue is especially valid because of the low numbers of expert health workers in territories such as Sub-Saharan Africa and South Asia. It was observed that only 51% of women in developing countries benefited from professional care during the past decade [2]. This shows that millions of births are not performed by health experts. On the contrary, in developed nations, all pregnant women have a minimum of four antenatal care visits. These visits are performed by an expert health worker during childbirth and postpartum periods. However, in developing nations, only 40% of all pregnant women have the suggested and necessary antenatal care visits [2].

This study investigates the variation in MMR and the delivery rate in a health center before and after the Guest Motherhood Project (GMP) in Turkey. It also examines the effect of low transportation facilities on maternal mortality and delivery in a health center.

2. MATERNAL MORTALITY

2.1. An Overview of the Turkey Issue

One out of every five women usually dies due to maternal mortality in Turkey [13]. In the last 30 years, several MMR estimates have been made in Turkey. MMR was estimated at 208 and 132 per 100,000 live births in the 1974-75 period and 1981, respectively [14, 15]. In 1996, the Turkey Ministry of Health (MoH) conducted a survey to determine maternal mortality in 53 provinces. It was found that the MMR was at 49.2 per 100,000 live births [13]. Further studies conducted in 1998 and 2005 portrayed this ratio at 49 and 28.5 per 100,000 live births [16, 17]. Between October 2004 and December 2006, a National Maternal Mortality Study (Turkey-NMMS) was conducted by a consortium comprising the Hacettepe University Institute of Population Studies (HUIPS), the Icon Institute Public Sector (Germany) and BNB Consulting (Turkey). In [17]'s study, it was aimed to:

- Obtain MMR in Turkey (Urban and Rural 12 regions of Turkey),
- Identify medical problems and socio-economic parameters on maternal conditions,
- Contribute and improve the reporting system for maternal deaths,
- Attract the attention of administrators and health professionals by collecting uniform and reliable information about the importance of maternal mortality as a precondition to improving MMR.

In this study, [17] surveyed 29 provinces which account for 54% of the total population, using a weighted stratified probability sampling method. From the conducted survey, MMR (number of maternal deaths per 100,000 live births) was determined as given in Figure 1.

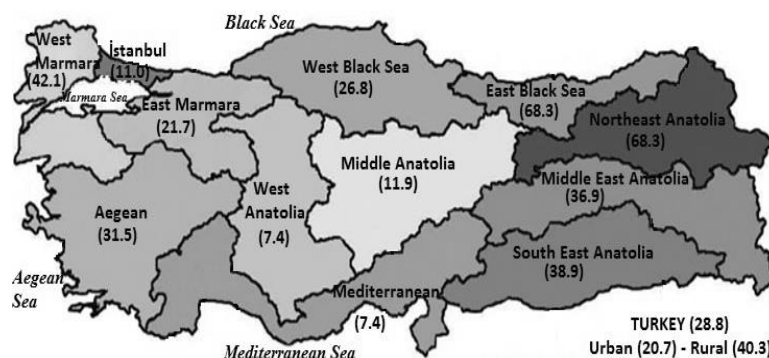


Fig. 1. MMR before GMP in different regions of Turkey [17]

According to the study results of [17], MMR was estimated at 28.5 per 100,000 live births in Turkey. However, it was discovered that the most important parameters of these results are the residential and regional differences (Figure 1). They found the lowest MMR in West Anatolia (7.4) and the highest in Northeast Anatolia and East Black Sea (68.3). In addition, the study results indicate that the MMR in Turkey shows differences strongly by age. The old and very young women have higher risks than the others. According to the study results, the lowest ratio was in the 20-24 years age group (10.2), and the highest was in the 45-49 years age group (146.7). [17] and [18] classified medical causes, time and location of the maternal mortality as presented in Table 1.

Tab. 1.

Medical causes, time and location of MMR in Turkey [17, 18]

Factor Explanation	Parameter	Percentage (%)
Direct Causes	Hemorrhage	24.9%
	Edema, proteinuria and hypertensive disorders	18.4%
	Other specified direct causes	15.7%
	Unspecified direct causes	10.1%
	Pregnancy-related infections	4.6%
	Suicide	3.2%
Indirect Causes	Maternal deaths	21.2%
	Diseases of the circulatory system	47.8%
	Malignancies	13%
Period	Ante-par-tum period	37%
	Delivery	9 %
	Post-partum period	54%
Location	Secondary and tertiary level health facilities	60%
	Home	21%
	Accident/Road	19%

The Turkey Health Statistics show that 80% of its maternal mortality was caused by bleeding, infection, hypertension, hard labor and abortion [18]. Reasons for maternal mortalities in Turkey can be classified and summarized thus (Figure 2)[19]:

- Direct reasons: These occur during pregnancy such as hemorrhage, sepsis, eclampsia, embolism and complications of cesarean section.
- Indirect reasons: These are attributable to health problems of women before pregnancy and birth. Additionally, they are aggravated by physiological changes that occur during pregnancy, such as diabetes, HIV/AIDS, anemia, heart disease and suicide.
- Incidental reasons: It can be defined as without pregnancy-related death of a woman. For example, these reasons can be traffic accidents, transportation delays, the lack of health centers, long distances to health centers, etc. Incidental reasons for maternal mortality are excluded from the calculations. However, incidental mortalities generate 23.2% of maternal mortalities.
- Random reasons related to pregnancy. The reasons for these types of maternal mortalities are not exactly known.

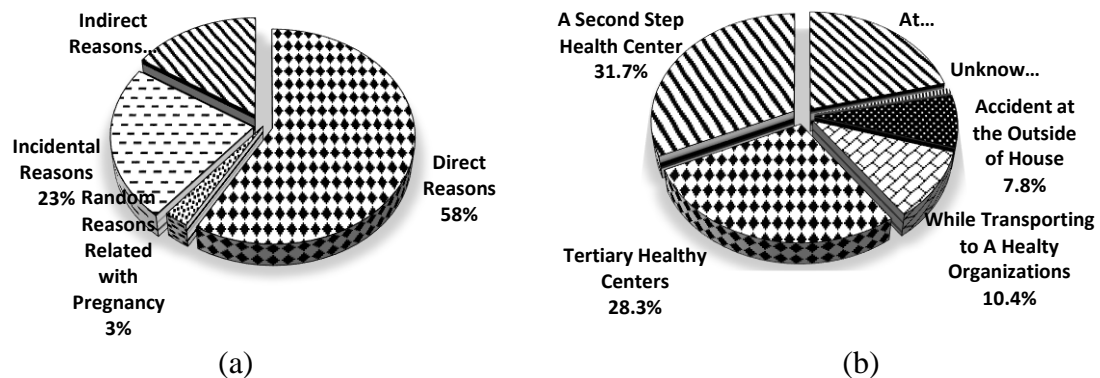


Fig. 2. (a) Reasons, and (b) locations of maternal mortalities [19]

Reducing MMR is one of the main aims of the MoH in the last decade. It is seen from previous research and applications that rational solution approaches should be used to reduce maternal mortality. First, maternal mortality records should be kept detailed and reliable. In this manner, accurate results can be obtained. If antenatal and puerperium are observed and performed regularly in a detailed manner, maternal mortality would reduce. Furthermore, if health centers are given the necessary equipment and an organized connection between healthy organizations in the same city is established, then maternal mortalities would significantly decrease.

2.2. Effect of Low Transportation Facilities

Obstetric risk factors are frequently present; therefore women with high-risk pregnancies should seek prenatal care early [20-22]. Most women experience at least one delay, that is, a missed “window of opportunity” that is potentially critical to the outcome. Research indicates that delays are ultimately related to the women being poor, lack of education, information and awareness, adverse experiences with healthcare staff, gender inequality, a lack of safe, accessible, low-cost transport mechanisms, a shortage of medical supplies, trained and motivated staff at health facilities [23-25].

To prevent maternal mortality, all women should access maternal health services during pregnancy and professional care before, during and after childbirth. In Turkey, most maternal deaths are related to socio-economic factors, equity issues, health services and transportation facilities. Especially, transportation facilities to health centers play an important role in preventing maternal deaths. Accessibility of pregnant women to health centers is one of the important factors for many rural regions of Turkey. Every year, approximately 7000 village roads are closed due to adverse weather conditions in Turkey [26]. In such regions, women without access to health care facilities give birth in unsuitable conditions because of low-income levels and regional transportation facilities [27]. Researchers found that in the Eastern Anatolia region, MMR and birth rates (BR) outside of health institutions are higher than in the other six regions. This situation was caused by the low-income level and transportation facilities to the health centers [8, 28]. In Figure 1, it can be seen under incidental reasons that delays in transportation is one of the most common reasons for maternal mortality in Turkey before 2008. Earlier researchers mentioned that the birth of a pregnant woman through professional support in health centers would reduce maternal mortality. The birth of a pregnant woman living far away from the urban area should be administered in a health center. Especially, in the winter season, hazardous driving environments caused by adverse weather conditions, poor roads, and transportation and/or complex territory conditions can be observed in many regions of Turkey

[26]. These adverse conditions may significantly increase the risk of accidents and delays for vehicles [29]. Moreover, many deaths occur outside tertiary health centers due to a lack of access to healthcare services

3. GUEST MOTHERHOOD PROJECT (GMP)

To reduce maternal mortality, transportation facilities to health centers should be promoted so that everyone can have equal health services. From 1981 to 2007, MMR reduced rapidly in urban areas compared to rural areas. This result is probably due to the economic and healthcare facilities in the rural areas. Subsequently, the Turkey Ministry of Health (MoH) aimed to reduce MMR in rural areas by initiating the “Guest Motherhood Project (GMP)” in October 2008 to cover both urban and rural areas. To prevent the negative effect of the winter season and adverse transportation facilities on maternal mortality, MoH applied the GMP in September 2008. Within this project, health services for pregnant women in risky regions were restructured. It has eliminated the difficulties in reaching health facilities and provided quick access to the rural areas and the challenging territories of Turkey. In the scope of this project, the GMP aimed to:

- Prevent traditional home delivery.
- Support and provide hospital delivery among rural women. Thus, maternal death risk can be prevented.
- Give special priority to mother and child healthcare.
- Determine risky pregnant women with low-income levels and transport facilities in health centers. These determined pregnant women are transferred to the city central and put in a health center until birthing. After a healthy birth, the mother and baby are transported home.
- Increase intersectoral cooperation, provision of health services and access to health services.
- Bring maternal mortality to the public’s agenda and create awareness among people on the issue.
- Attract the attention of health personnel on the issue and increase health service quality.
- Provide education and consultancy services on prenatal care, healthy birth and postnatal care.
- Administer prenatal care to pregnant women.

In the scope of this project, first, regions with adverse weather conditions and low transportation facilities were determined and evaluated as risky regions in the cities. Thus, a risky regions map was prepared for all cities in Turkey. Then, the names of the pregnant women living in risky regions were listed and arranged according to their probable day of birth and place. In these lists, some necessary information about the pregnant women were recorded, such as name, address, date of birth, etc.). To ensure a successful birth, all risks are explained to the pregnant women and their families. Before the last month, health experts in these risky regions regularly monitored these pregnant women. In the last month of the pregnancy, family doctors decide on the priority of these pregnant women as guests for the health centers. After acceptance, the pregnant women are invited to health centers. They are welcomed near the health facilities (hospital, hotel or public guesthouses) a couple of weeks before delivery. The cost of these services is financed by the MoH. Steps for applying the GMP are expressed in the diagram in Figure 3.

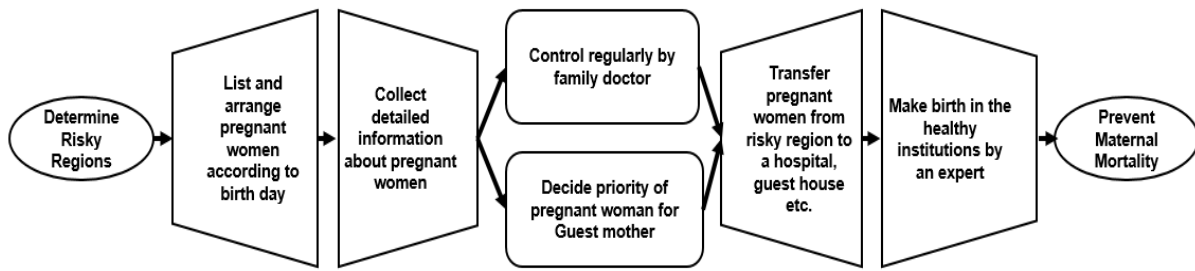
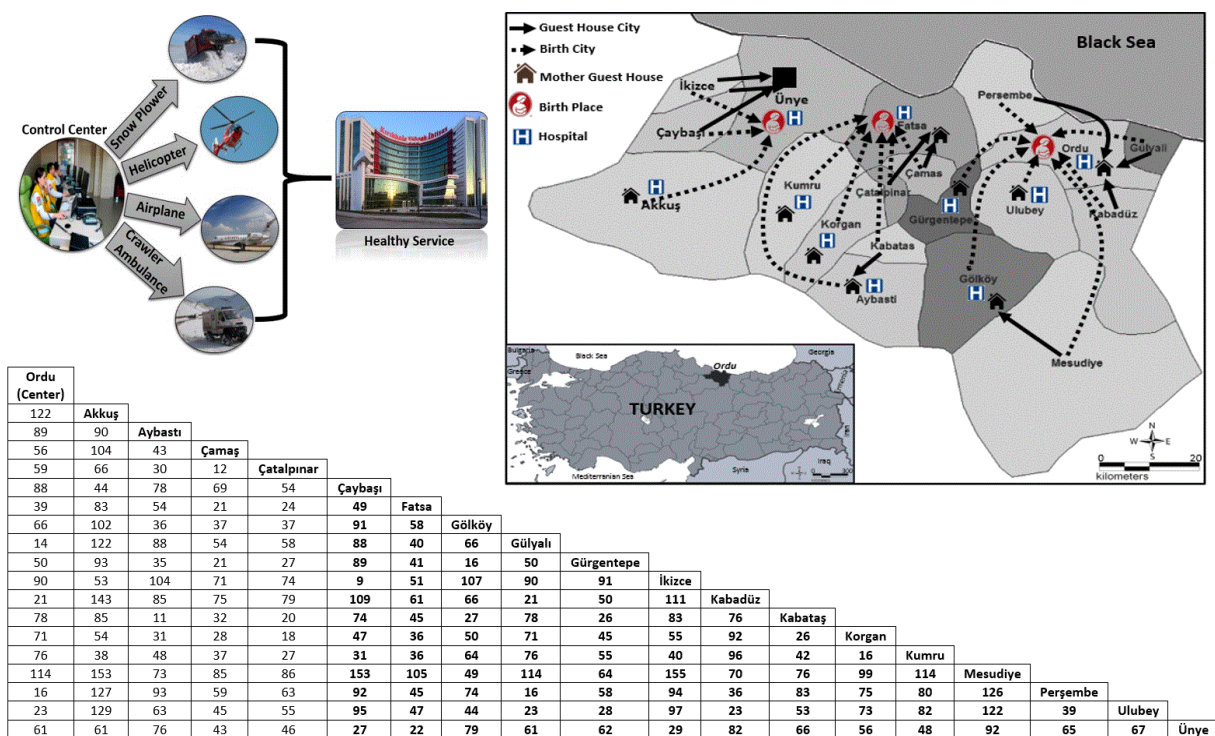


Fig. 3. A flow chart for applying the GMP process

In this study, Ordu City was chosen to explain GMP. Hence, the risky counties of Ordu City were determined. The transport and the guest plans of the pregnant women from these counties to health centers are shown in Figure 4. It can be seen from Figure 4 that the transport and the transfer plan map of the pregnant women were prepared for all counties of Ordu City.

According to the plan, first, pregnant women will be guests in the downtown county. Then they will be transferred to a health center for birthing. On the other hand, if there is a premature birth in the rural areas, the transport of the pregnant woman to a health center will be ensured using a helicopter, airplane, tracked ambulance or a snow plower ambulance, as shown in Figure 4.



*Numeric values shows the distance (km) between counties of Ordu City in Turkey.

Fig. 4. GMP action plan for the counties of Ordu City, Turkey

4. RESULTS

Maternal mortality can be prevented by observing basic precautions. GMP is a good example of such basic precautions. GMP started in October 2008, and 230,254 pregnant women were invited to the project between 2008-2014. However, 63,446 pregnant women accepted the project's invitations, and 29,059 pregnant women have benefited from their services (Table 2). Detailed statistics of the project are summarized in Table 2.

Tab. 2.

GMP Statistics [30]

Number	Years							Total (Σ)
	2008	2009	2010	2011	2012	2013	2014	
Number of pregnant number invited for more convenient conditions	3091	43,829	41,386	36,318	36,318	35,558	33,889	230,254
Number of pregnant women who accepted the invitation	794	8407	7550	6360	12,744	13,558	14,289	63,446
Number of pregnant women who were guests	243	6253	5699	4795	5340	3579	3150	29,059
Number of pregnant women who stayed at health centers and birth	243	6194	5661	4767	5312	3290	2977	28,444

Current maternal mortality statistics show that mortality has decreased significantly through GMP in Turkey since 2008. For example, in 1983, before the GMP, in the east of Turkey, 84% of the pregnant women delivered outside health institutions; however, with GMP, this percentage decreased by 6.9% in 2013 [13, 18].

Furthermore, the maternal mortality rate in East Turkey has decreased by 26.3 per 100,000 live births. This rate was 15.9 per 100,000 live births countrywide in 2013 [18]. The positive effects of this project can be easily seen from the maternal mortality estimation of [2] (Table 3).

Tab 3.

MMR in Turkey (Maternal deaths per 100,000 live births) [2]

Year	Maternal Mortality Ratio (MMR) [Per 100,000 live births (lb)]	Maternal Deaths [Numbers]	Live Births [Thousands]	Proportion of Maternal Deaths Among Deaths of Female Reproductive Age [PM %]
1990	97 [63-149]	1400	1406	5.4
1995	86 [59-127]	1200	1383	4.6
2000	79 [59-108]	1100	1369	4.2
2005	57 [52-63]	760	1323	3.1
2010	23 [20-27]	300	1306	1.3
2015	16 [12-21]	210	1289	0.9

Table 3 presents the maternal mortality statistics of Turkey between 1990 and 2015 [2]. Results show that maternal mortalities have decreased significantly since 1990. In 1990, 532,000 deaths were observed, and this ratio is estimated approximately 303,000 mortality deaths in 2015 [2]. These results mean that there was a 44% reduction in maternal deaths between 1990 and 2015.

Regression analysis of the MMR statistics of Turkey shows that MMR has an exponential distribution, as given in Figure 5(a). The reductions in MMR before GMP in 2006 and after the project in 2014 are shown in Figure 5(b). The figure shows that the highest decrease is seen in the Northeast Anatolia region and the lowest in İstanbul. However, an increase is observed in the Middle and West Anatolia regions. Results show that the MMR have regional differences, as shown in Figure 5(b).

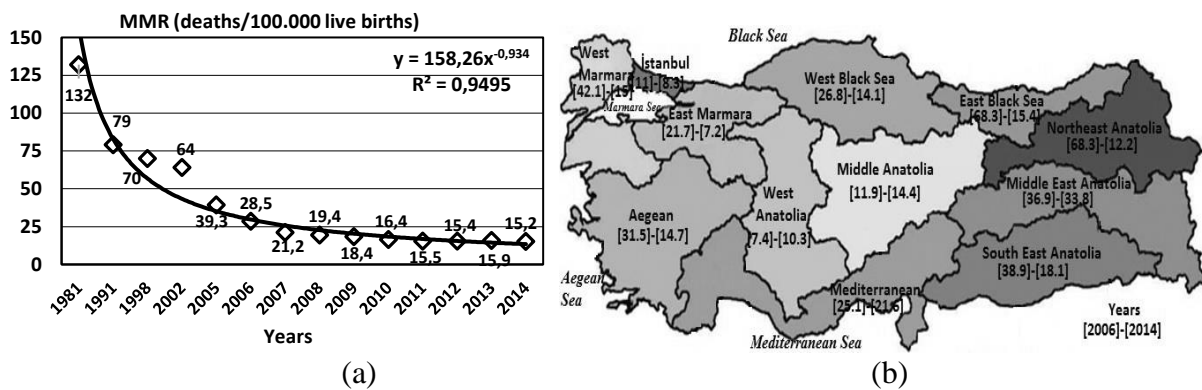


Fig. 5. (a)Regression analysis results and (b) changes of MMR before and after GMP in Turkey.

Figure 6 presents the regression model of the ratio of deliveries annually in health centers. Findings show that the ratio of deliveries annually in health centers has a linear distribution, as given in Figure 6(a). Thus, this means that the ratio of deliveries outside hospitals was 60% in 1983; however, this percentage decreased by 2.2% in 2013, and this ratio has increased linearly in the past two decades (Figure 6a). According to the 2014 statistics, deliveries outside health centers were about 98% in Turkey [26]. Increase in the ratio of deliveries from 2002 to 2014 is seen in Figure 6(b). The figure shows that the highest increase is seen in the Middle East and South-East Anatolia regions and the lowest in the West Marmara region. However, an increase is observed in Middle and West Anatolia. In these areas, the delivery rate in hospitals increased by 8% and the MMR decreased by 4.2% between 2008 and 2014 because of GMP [26-31]. These results proved that GMP had good results despite the regional disparities. On the other hand, the population of rural regions have decreased linearly from 29.5 to 12.8% between 2007 and 2014, respectively [26]. Also, it would be noted that this reduction has a positive effect on low MMR, as well as GMP.

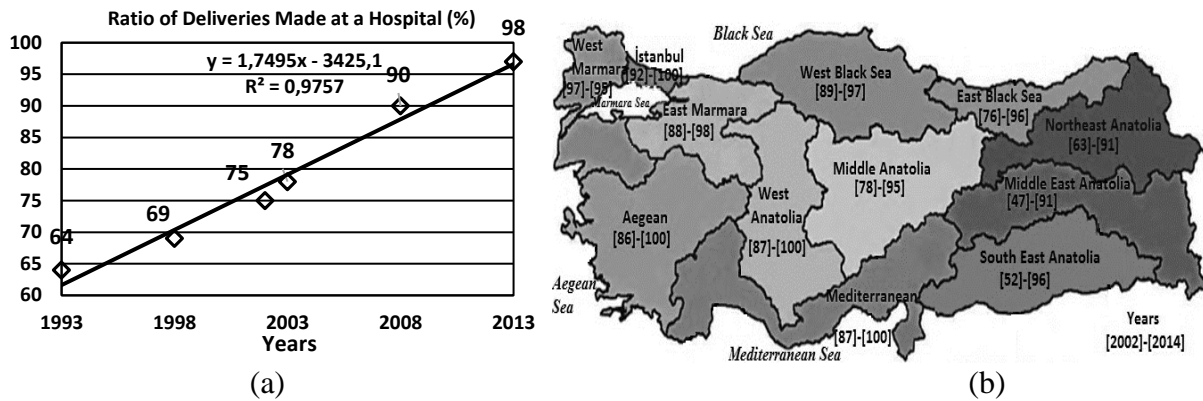


Fig. 6. (a) Regression analysis results and (b) changes in the ratio of deliveries annually at birth centers in Turkey before and after GMP.

5. DISCUSSION AND CONCLUSION

Maternal death is a major international health problem for many attributable reasons. Every year, many pregnant women die because of low transport conditions to health organizations for proper care [32]. Internationally, maternal mortality problems are evaluated through the millennium development goals [33]. Economic stability is crucial in maintaining government healthcare spending, which provides effective maternal healthcare resources to minimize maternal mortality. A reduction in GDP per head could result in a decrease in countries' healthcare spending with detrimental effects on strategies implemented to improve women's health.

In the last decade, the Turkish economy has grown rapidly. Also, the safety of pregnant women has become accepted as a priority health problem by the MoH and health workers. Accordingly, MMR has rapidly decreased in urban and rural areas. Today, this ratio approximately has similar rates as recorded in developed countries, as given in Figure 7.

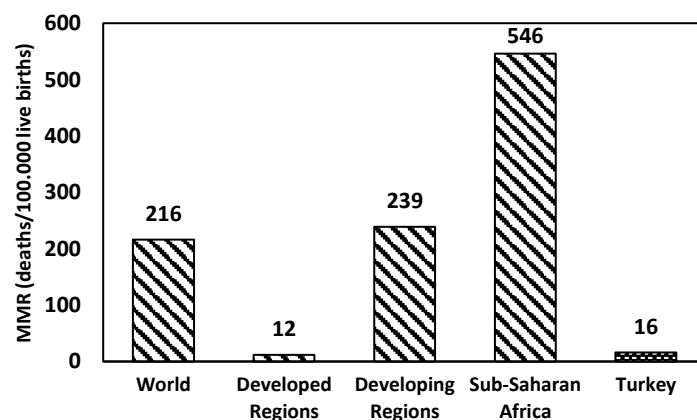


Fig. 7. Maternal mortality ratio (MMR/100,000 live births) [2, 26]

The established health system in Turkey could serve as a model for other developing countries. Statistics indicate that the MMR was 21.2 per 100,000 live births before GMP. However, after GMP, this ratio is reported as 15.2 per 100,000 live births in 2014 by the Turkey Health Statistics [26]. These developments in the health statistics were also seen in both UNICEF and EU reports [26]. These reports mentioned Turkey as one of the countries showing significant developments in the reduction of maternal mortality.

Low income, long distance to health centers, low education level, inadequate service conditions and cultural practices are significant factors in maternal mortality. To prevent maternal mortality, awareness of the community about maternal health should be increased using different communication devices. Additionally, appropriate policies and projects, such as the GMP, should be developed and applied. These types of projects can provide high quality delivery services at all health centers in every region of countries.

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