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Changing trends in the Turkish maternal deaths, with a focus on direct and indirect causes

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ABSTRACT

Objective: Our aim is to evaluate trends in the direct and indirect causes' distribution using data from National Maternal Mortality Surveillance (2012–2015).

Study design: A population-based retrospective review was performed on all pregnancy-associated maternal deaths in Turkey from 2012 to 2015. Causes of death were grouped into direct and indirect maternal deaths and compared in the context of distribution. Maternal mortality rate was reported. Statistics included chi-square test or Fisher's exact test for categorical variables.

Results: Between 2012 and 2015 there were 812 maternal deaths. The maternal mortality rate was 15.4 deaths per 100,000 live births in 2012 as compared to 13.7 in 2015. Direct maternal deaths in Turkey declined from 59.5% in 2012 to 45% in 2015 while indirect maternal deaths increased from 45% in 2012 to 55% in 2015 ($p = 0.045$). The leading direct causes of maternal deaths were postpartum hemorrhage. The major indirect causes of maternal deaths were circulatory system diseases.

Conclusion: Direct maternal deaths in Turkey appear to be declining. This data will aid the management of maternal deaths.

Introduction

Maternal death is accepted as the death of a woman during pregnancy or within 42 days of the termination of a pregnancy from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. The maternal mortality rate (MMR) (described as the number of maternal deaths per 100.000 live births) arranges handling for the obstetrician in the context of maternal mortality information [1]. Sustainable Development Goals (SDGs) accepted by global community set a target below 70 maternal deaths per 100.000 live births by 2030 [2].

Maternal mortality can be classified as direct and indirect mortality. It is well known that the most important direct causes of maternal death are obstetrical hemorrhage, hypertensive disorders of pregnancy, abortion, and sepsis. Indirect maternal deaths are from non-pregnancy related causes which become aggravated by the pregnancy (for example cardiac disease) (3).

Trends in the direct and indirect causes' distribution were analyzed using data from National Maternal Mortality Surveillance (2012–2015).

Materials and methods

A population-based retrospective review was performed on all pregnancy-associated maternal deaths in Turkey from 2012 to 2015.

Data was collected from National Maternal Mortality Surveillance database of Ministry of Health. Maternal deaths were analyzed by Investigation Committee which consists of one obstetrician, one perinatalog, and one anesthesiologist, one specialist in internal medicine and additional relevant specialists. After the evaluation of the medical records and autopsy reports, agreement of at least three reviewers was essential to designate a final cause of death.

WHO ICD-10 Manual and The WHO Application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM (Maternal Mortality) were utilized for the definitions [4]. Causes of death were grouped into direct (obstetric hemorrhage, hypertensive disorders of pregnancy, obstetric embolism -amniotic fluid embolism end pulmonary embolism-, pregnancy-related infections), indirect (diseases of circulatory system, mental disorders and

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diseases of the nervous system and maternal infectious diseases, diseases of the respiratory system, endocrine diseases, diseases of the digestive system and other specified diseases such as malignancies or autoimmune disorders complicating pregnancy, childbirth and the puerperium), incidental deaths or accidents, or unknown. Exclusion criteria were late maternal (more than 42 days but less than 1 year after the termination of pregnancy) and accidental or incidental deaths. A report on cause of death and recommendations based on delays were arranged by the Committee for Policy. Data on maternal age, cause of death, mode of delivery were collected.

The data were entered into a database and analyzed. We used the statistical software package SPSS 16.0 (SPSS Inc., Chicago, IL) for the analyses. The results were presented as frequencies, percentages, and descriptive summary statistics. Chi-square test or Fisher's exact test were used for comparison of categorical variables. Significant differences were described as comparisons with probability value of less than 0.05 and 95% confidence interval (CI). $p < 0.05$ was considered statistically significant.

Results

Between 2012 and 2015 there were 812 maternal deaths. The MMR was 15.4 deaths per 100.000 live births in 2012 as compared to 13.7 in 2015. The median age of the women in 2012 was 32 (18–49) years as compared to 32 (16–44) in 2015.

Among maternal deaths, MMR in 2012 were 48.5 /100.000 live births (66 deaths) in women over 35 years and 12.2 (126 deaths) in women below 35 years (Tables 1 and 2), giving an adjusted OR of 3.97 for women >35 years (95% CI: 2.95–5.34) (Table 2).

Table 1
Maternal deaths in women over 35 and below 35 years age.

	< 35 years	≥35 years	Test statistic	
Year	n (%)		χ^2	p
2012	126 (65.6)	66 (34.4)	2.791	0.425
2013	157 (70.1)	67 (29.9)		
2014	141 (66.2)	72 (33.8)		
2015	114 (62.3)	69 (37.7)		

The mean cesarean rate in 2012 was 48% compared to 53.1% in 2015. Compared with women delivered vaginally, the unadjusted odds ratio (OR) of maternal death was 5.44 (95% CI: 3.84–7.72) among women delivered by cesarean section in 2012 (Table 3).

When the reasons of maternal mortalities between 2012–2015 were analyzed, out of 812 deaths, while 51.1% (n = 415) occurred because of direct causes 45.8% (n = 372) was caused by indirect reasons. In 25 (3.1%) cases, as specific cause of death couldn't be determined, they were accepted as unknown / undetermined obstetric death.

In that period 2012–2015 in Turkey, the rate of pregnant women ≥35 years old was calculated as 12.9%. Similarly, 12.6% of the maternal deaths were occurred also above 35 years of age. When the maternal death causes were investigated according to the maternal ages, 54.0% (282/522) of the maternal deaths below 35 years old were due to direct causes and 46.0% were indirect reasons, while these rates were 50.2% (133/265) and 49.8%, respectively (p = 0.309).

Direct maternal deaths in Turkey declined from 59.5% in 2012 to 45% in 2015 while indirect maternal deaths increased from 45% in 2012 to 55% in 2015 (p = 0.045) (Table 4). The leading direct causes of maternal deaths were postpartum hemorrhage. The major indirect causes of maternal deaths were diseases of circulatory system (Table 5).

Discussion

Data from different countries revealed that the incidence of direct maternal deaths is highly heterogeneous among countries but there is little information available for Turkey. The investigation of temporal trends in direct and indirect maternal deaths is essential to inform policy makers and to set up interventions for bringing down the MMR.

In West Bengal 90.4% of all maternal deaths was due to direct causes whereas indirect causes accounted for 9.52% of maternal deaths [5]. Direct causes of maternal deaths lead maternal mortality in South Africa [6]. Tuberculosis was the most frequent indirect cause of maternal deaths while hypertensive disorders of pregnancy were the leading cause of direct maternal deaths [7]. No significant decrease was observed in the rate of indirect maternal

Table 2
Death probability trends based on age in years.

Year	Live Births (n)		Maternal Deaths (n)		Mortality rate[a]		Test statistics		
	Age (years)						X^2	p	OR (95% CI)
	<35	≥35	<35	≥35	<35	≥35			
2012	1.030.268	136.020	126	66	12.23	48.52	96.093	<0.001	3.97 (2.95–5.34)
2013	996.831	143.480	157	67	15.75	46.70	61.123	<0.001	2.97 (2.23–3.95)
2014	1.045.954	161.858	141	72	13.48	44.48	76.366	<0.001	3.30 (2.48–4.38)
2015	1.018.900	168.370	114	69	11.19	40.98	83.177	<0.001	3.67 (2.72–4.94)

[a] Number of maternal deaths per 100.000 live births.

Table 3
Death probability trends based on route of delivery in years.

Year	Live Births (n)		Maternal Deaths (n)		Mortality rate[a]		Test statistics		
	Route of Delivery								
	Vaginal	C/S[b]	Vaginal	C/S	Vaginal	C/S	χ^2	p	OR (95% CI)
2012	1.239.062	614.046	43	116	3.47	18.89	113.775	<0.001	5.44 (3.84 – 7.72)
2013	1.258.357	646.175	56	131	4.45	20.27	108.713	<0.001	4.55 (3.33 – 6.23)
2014	1.305.825	683.916	43	122	3.29	17.84	114.500	<0.001	5.41 (3.83 – 7.67)
2015	1.297.644	698.120	35	102	2.70	14.61	93.842	<0.001	5.41 (3.69 – 7.95)

[a] Number of maternal deaths per 100.000 live births.
[b] Cesarean section.

Table 4
Direct and indirect maternal death distributions according to the years.

Year	DIAGNOSIS		Test Statistics	
	DIRECT n (%)	INDIRECT	χ^2	p
2012	113 (59.5)	77 (40.5)	8.044	0.045
2013	112 (51.1)	107 (48.9)		
2014	113 (54.6)	94 (45.4)		
2015	77 (45.0)	94 (55.0)		

deaths in England since 2003. In 2011–2013, indirect causes accounted for 68% of all maternal deaths, and cardiac disease was the leading cause [8]. Nordic countries reported 168 maternal deaths, 90 direct and 78 indirect cases. Direct maternal deaths went beyond indirect deaths. Circulatory system diseases (n = 29) seem to be the most frequent cause of death [9]. The leading 3 causes of maternal mortality in the United States from 2011 to 2013 were circulatory system disorders (15.5%), other medical non-circulatory system diseases (14.5%), and sepsis (12.7%) followed by hemorrhage (11.4%) [10].

In the present study data from the National Maternal Mortality Surveillance in Turkey were analyzed for changes between 2012 and 2015. Direct maternal deaths in Turkey declined from 59.5% in 2012 to 45% in 2015 while indirect maternal deaths increased from 45% in 2012 to 55% in 2015. There is a significant shift in distribution of maternal deaths. The direct causes of maternal deaths were generally hemorrhage. Circulatory diseases were the major causes of indirect maternal deaths.

The total annual number of maternal deaths decreased globally from 376 034 in 1990, to 292 982 in 2013. The reduction accelerated steadily from 1990 to 2013, with corresponding decreases in MMR. Except for late maternal deaths and HIV-related deaths, the absolute numbers of deaths due to every cause decreased significantly from 1990 to 2013. Globally, the biggest absolute reduction was in deaths due to maternal hemorrhage. The proportion of maternal deaths due to indirect causes increased slightly from 9·1% in 1990, to 10·2% in 2013 [11]. A World Health Organization (WHO) analysis of the causes of maternal death estimated that more than a quarter (28%) of the deaths between 2003 and 2009 were due to indirect causes [3]. In high-income countries, indirect causes are widely recognized as contributing to a high proportion of maternal deaths [12]; however, there has also been a significant increase in the proportion of deaths due to medical comorbidities other than HIV globally between 1990 and 2013. Worldwide, of the maternal deaths occurring within 42 days after the end of pregnancy, 15% are estimated to be due to pre-existing medical conditions, making these the second most important underlying cause of maternal death after hemorrhage (27%) [3].

The mortality causes may differ by regions. The two most important reasons of maternal death in high-income regions in 2013 were indirect and other direct causes, owing largely to a decrease in abortion-related deaths, which was the most important cause of maternal mortality in high-income regions in 1990. The number of deaths due to hemorrhage, hypertension, and maternal sepsis have also decreased significantly, whereas the numbers of deaths due to indirect maternal causes have increased since 1990. By contrast, the most important causes in low-income countries have not changed between 1990 and 2013 [11].

Indirect maternal deaths are more than direct deaths due to obstetric causes in many high-income countries, and there has been a significant increase in the percentage of maternal deaths due to indirect medical causes in low- and middle-income countries. There has been no major decrease in the rate of indirect maternal deaths in the UK since 2003.

Over the period between 2003–2005 and 2011–2013, maternal deaths in the UK decreased by 35%, but this was primarily driven by a decrease in direct deaths [13]. In contrast, there was no significant decrease in the rate of indirect maternal deaths over the same time period. In 2011–2013, more than two-thirds (68%) of maternal deaths in UK were due to indirect causes and cardiac disease was the major cause followed by sepsis due to all causes including influenza and pneumonia, neurological causes including epilepsy and other indirect deaths [12]. It was emphasized that the major problems identified in care of women who died from an indirect cause was a lack of clarity about which medical professional should take responsibility for care and overall management [13]. There has been evidence of a shift in incidence from direct to indirect maternal deaths in many low- to middle-income countries due to an increase in non-communicable diseases. Irrespective of the significant gains made in reducing maternal mortality in many countries worldwide, there is evidence of a stable increase in the amount of indirect deaths due to pre-existing medical co-morbidities. This enhances the require for research the evidence about the risk factors, management and outcomes of specific medical comorbidities during pregnancy in order to provide appropriate evidence-based multidisciplinary care from conception to the end of puerperium [13].

Table 5
The causes of maternal deaths.

	DIAGNOSIS	YEAR			
		2012 n (%)	2013	2014	2015
DIRECT CAUSES	Obstetric hemorrhage	35 (18.2)	42 (18.8)	41 (19.2)	28 (15.3)
	Hypertensive disorders of pregnancy	33 (17.2)	38 (17.0)	29 (13.6)	26 (14.2)
	Obstetric (amniotic fluid/ pulmonary) embolism	37 (19.3)	19 (8.5)	26 (12.2)	11 (6.0)
	Pregnancy-related infections	5 (2.6)	9 (4.0)	14 (6.6)	4 (2.2)
	Other direct causes	3 (1.6)	4 (1.8)	3 (1.4)	8 (4.4)
INDIRECT CAUSES	Diseases of the circulatory system	42 (21.9)	54 (24.1)	44 (20.7)	40 (21.9)
	Mental disorders and diseases of the nervous system	7 (3.6)	6 (2.7)	8 (3.8)	8 (4.4)
	Indirect infections	8 (4.2)	28 (12.5)	21 (9.9)	25 (13.7)
	Neoplasms	0	0)	3 (1.4)	2 (1.1)
	Other indirect causes	20 (10.4)	19 (8.5)	18 (8.5)	19 (10.4)
Unknown / undetermined		2 (1.0)	5 (2.2)	6 (2.8)	12 (6.6)
Total		**192 (100.0)**	**224 (100.0)**	**213 (100.0)**	**183 (100.0)**

In a systematic review included twelve articles provided data from 1980 to 2007, the direct Maternal death rate was found as 8.98 being postpartum hemorrhage the leading cause, and indirect MMR was 3.68, with cardiovascular disease as the main cause. Noteworthy, 0.22 deaths per 100,000 live births are associated with unknown etiology. The review indicated that pregnancy-associated maternal mortality ratio accounts for approximately 13 per 100,000 live births. Of these, 79% results from direct obstetrics causes and 24% results from adverse conditions that develop or worsened during pregnancy [14].

In a study from France, for the 10-year period (1998–2007) 660 maternal deaths were identified [15]. The maternal mortality ratio was similar in the two 5-year periods, 8.8 per 100,000 live births for 1998–2002 and 8.4 per 100,000 live births for 2003–2007. Overall, hemorrhage was the leading cause of death, responsible for 18% of maternal deaths, followed by amniotic fluid embolism (12%), thromboembolism (11%), hypertensive disorders (10%), and cardiovascular conditions, each of which contributed to 10–12% of deaths. Suboptimal care decreased from 70% in 1998–2002 to 60% in 2003–2007. This difference was mainly attributable to the decrease in suboptimal care in the deaths attributable to indirect causes. Suboptimal care was most prevalent (approximately 80–90%) for specific leading causes of death, particularly hemorrhages and hypertensive disorders. During both periods, approximately two thirds of the women died due to direct obstetric causes. Although the maternal mortality ratio from indirect causes was decreased from 63.6% between 1998–2002 to 46.7% between 2003–2007, the difference was not statistically significant during both periods; cardiovascular conditions and cerebrovascular accidents were the leading indirect causes and did not also change significantly over time [15].

In a recent study from France was reported that direct maternal mortality decreased over the last 10 years and in particular maternal mortality from hemorrhage decreased statistically significant, which was divided by 2 in that period. This decrease is one of the indicators that improved obstetric care. However, hemorrhage is still the leading cause of maternal mortality in France (11% of deaths) [16].

Numerous studies have documented increases in indirect maternal death incidence in developed countries [8,10]. Advanced maternal age is more likely to be associated with increased risk for maternal and neonatal morbidity and mortality. The literature has previously suggested that the association between age and maternal mortality can be fully explained by medical comorbidities. One possible explanation being that older women undergo cardiovascular ageing and older women are more likely to have symptoms of an underlying undiagnosed cardiovascular condition that results in an inability to adapt to the normal physiological changes that occur during pregnancy [17]. Thus, the weakened vascular system in older women is unable to compensate fully for the physiological demands that occur during pregnancy, which in turn increases the risk of cardiovascular events, pregnancy-induced hypertension and other complications [18]. McCall et al. stated that an exploratory analysis examining medical co-morbidities highlighted that cardiac disease, essential hypertension, infection, musculoskeletal disorders, asthma, mental health problems, inflammatory disorders and neurological conditions were all independently associated with maternal morbidity and mortality in women of advanced maternal age [19]. Although direct and indirect causes are similar in maternal deaths under 35 years of age and above, indirect causes in cases above 35 years are approximately 4% more. This data may explain the cause of the high mortality rate among pregnant women above 35 years. This highlights once again the importance of high-quality pre-pregnancy as well as antenatal and post-pregnancy care for women with co-morbidities, especially among older women.

After Preliminary Investigation Committee on Confidential Inquiries into Maternal Deaths in Turkey has begun working in 2007, the committee investigated the medical records of e all maternal deaths. Through the lessons learned from these deaths and data, some studies and settings were performed. One of these studies was preparing the national clear guidelines, particularly about the issues on direct causes such as acute-onset severe hemorrhage, acute onset-severe hypertension and venous thromboembolism during pregnancy and postpartum period [20–22], by the obstetrics societies with scientific contributions of the other academic associations and these guidelines were published and introduced into the practice by the health authority. Another setting was closely controlling and monitoring the critical blood and blood products stocks especially in the centers of birth, thus blood and blood products were easily provided when needed. There is also a significant increase in improvement in prenatal care and hospital births in Turkey in recent years. These caused the increase of rate to the developed countries levels. While the birth rate in a health care facility was 75% in 2002 it reached to 98% in 2016. This rate was 99% in EU countries, WHO European region and OECD countries, the world average was 79%. At the same time, at least intermediate quality prenatal care rate increased from 70% to 99%, although this ratio was above 96% in high-income countries and WHO Europe region and 83% around the world [23]. Because of these reasons, due to the decrease in the maternal deaths due to hemorrhage, pre-eclampsia and venous thromboembolism which were the leading causes of direct maternal deaths, the indirect maternal deaths have come to the fore.

Caesarean section (CS) rates continue to evoke worldwide concern because of their steady increase. Latin America and the Caribbean region have the highest CS rates (40.5%), followed by Northern America (32.3%). The mean rate of CS deliveries is 25% in Europe [24]. The average across all OECD countries has been reported as 32% in the OECD Health Data and 28% in European Union countries [23]. The CS rate in Turkey is unfortunately the highest in Europe. The rate of CS has increased more than two folds for the period of 2002–2016 in Turkey from 21% to 53.1% with 26.4% primary CS rate among all births in 2016 [23].

The reasons for this increase in CS rates can be classified as causes of the patient, the doctor and midwife, hospital-derived causes and medico-legal issues. In Turkey, the CS rate was higher in women who were under health insurance coverage, with childbirth in the private health facilities, first time deliveries, those staying in the Western region and urban areas, and having high-income [25].

Nonetheless, among all of the above-mentioned factors the medico-legal reasons were evaluated as the leading factor effective on the high cesarean rates in Turkey [26]. The most of the Turkish OB&GYNs denoted that the greatest concern among obstetricians who perform cesarean deliveries was malpractice litigation and 88% of them expressed their belief that the high CS rate was associated with medico-legal concerns of the OB/GYNs [27].

Issues to reduce maternal mortality caused by direct as well indirect causes in the future include multidisciplinary collaboration especially for indirect causes, implementation of national and/or international guidelines more effectively into the practice, establishing an early warning system in the health care system with the ability of detecting high-risk pregnancies. The increasing rates in indirect maternal deaths will be connected to programs focusing on antenatal and obstetric care, and refresher courses and in-service trainings particularly for obstetricians, family practitioners, emergency physicians, cardiologists and related internal medicine disciplines should be performed in order to increase awareness about the maternal mortalities.

Comment

As a conclusion, direct maternal deaths in Turkey appear to be declining. The present study acknowledges policy makers to make appropriate decisions to reduce indirect maternal deaths in Turkey.

Conflict of interest

The authors report no conflicts of interest.

References

[1] Alkema L, Chou D, Hogan D, Zhang S, Moller AB, Gemmill A, et al. United Nations Maternal Mortality Estimation Inter-Agency Group collaborators and technical advisory group. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. Lancet 2016;387:462–74.

[2] Boldosser-Boesch A, Brun M, Carvajal L, Chou D, de Bernis L, Fogg K, et al. Ending Preventable Maternal Mortality working group.. Setting maternal mortality targets for the SDGs. Lancet 2017;389:696–7.

[3] Say L, Chou D, Gemmill A, Ö. Tunçalp, Mollar AB, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. Lancet Glob Health 2014;2:e323–33.

[4] The WHO application of ICD-10 to deaths during pregnancy, childbirth and puerperium: ICD MM. World Health Organization 2012. WHO Press, World Health Organization, Geneva, Switzerland (Printed in France), available on the WHO web site (www.who.int).

[5] Bhadra B, Choudhury RR, Sarkar D, Sarkar S. An epidemiological study of mortality among mothers admitted in a rural tertiary hospital of West Bengal. J Family Med Prim Care 2017;6:270–3.

[6] National Committee on Interim Report on Confidential Enquiry into Maternal Deaths. Saving mothers: fifth report on confidential enquiries into maternal deaths in South Africa 2008–2010. Pretoria: National Department of Health South Africa; 2012.

[7] Bomela NJ. A cross-sectional analysis of the geographic distribution and causes of maternal mortality in South Africa: 2002–2006. BMC Public Health 2015;15:273.

[8] Nair M, Nelson-Piercy C, Knight M. Indirect maternal deaths: UK and global perspectives. Obstet Med 2017;10:10–5.

[9] Vangen S, Bødker B, Ellingsen L, Saltvedt S, Gissler M, Geirrson RT, et al. Maternal deaths in the Nordic countries. Acta Obstet Gynecol Scand 2017;96:1112–9.

[10] Ozimek JA, Kilpatrick SJ. Maternal mortality in the twenty-first century. Obstet Gynecol Clin North Am 2018;45:175–86.

[11] Kassebaum NJ, Bertozzi-Villa A, Coggeshall MS, Shackelford KA, Steiner C, Heuton KR, et al. Global, regional, and national levels and causes of maternal mortality during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2014;384:980–1004.

[12] M. Knight, D. Tuffnell, S. Kenyon, J. Shakespeare, R. Gray, J.J. Kurinczuk (eds) onbehalf of MBRRACEUK, et al. Saving lives, improving mothers' care – surveillance of maternal deaths in the UK 2011–2013 and lessons learned to inform maternity care from the UK and Ireland confidential enquiries into maternal deaths and morbidity 2009–2013. Oxford: National Perinatal Epidemiology Unit, University of Oxford., (2015).

[13] Nair M, Nelson-Piercy C, Knight M. Indirect maternal deaths: UK and global perspectives. Obstet Med 2017;10:10–5.

[14] Cristina Rossi A, Mullin P. The etiology of maternal mortality in developed countries: a systematic review of literature. Arch Gynecol Obstet 2012;285:1499–503.

[15] Saucedo M, Deneux-Tharaux C, Bouvier-Colle MH. French National Experts Committee on Maternal Mortality. Ten years of confidential inquiries into maternal deaths in France, 1998-2007. Obstet Gynecol 2013;122:752–60.

[16] Deneux-Tharaux C, Saucedo M. Epidemiology of maternal mortality in France, 2010–2012. Gynecol Obstet Fertil Senol 2017;45:S8–S21.

[17] van Katwijk C, Peeters LL. Clinical aspects of pregnancy after the age of 35 years: a review of the literature. Hum Reprod Update 1998;4:185–94.

[18] Care AS, Bourque SL, Morton JS, Hjartarson EP, Davidge ST. Effect of advanced maternal age on pregnancy outcomes and vascular function in the rat. Hypertension 2015;65:1324–30.

[19] McCall SJ, Nair M, Knight M. Factors associated with maternal mortality at advanced maternal age: a population-based case-control study. BJOG 2017;124:1225–33.

[20] Gulumser C, Engin-Ustun Y, Keskin L, Celen S, Sanisoğlu S, Karaahmetoglu S, et al. Maternal mortality due to hemorrhage: population-based study in Turkey. J Matern Fetal Neonatal Med 2018;11:1–7, doi:http://dx.doi.org/10.1080/14767058.2018.1481029.

[21] Keskinkılıç B, Engin-Üstün Y, Sanisoğlu S, Celen S, Sanisoğlu S, Karaahmetoglu S, et al. Maternal mortality due to hypertensive disorders in pregnancy, childbirth, and the puerperium between 2012 and 2015 in Turkey: a nation-based study. J Turk Ger Gynecol Assoc 2017;18:20–5.

[22] Engin-Üstün Y, Keskin HL, Karaahmetoğlu S, et al. Maternal mortality cases from pulmonary embolism: a nation-wide study in Turkey. J Obstet Gynaecol 2017;37:151–6.

[23] Health statistics yearbook 2016. Ankara: Republic of Turkey Ministry of Health, General Directorate of Health Research; 2017. p. 71–4. . Available at: https://dosyasb.saglik.gov.tr/Eklenti/13160,sy2016enpdf.pdf?0.

[24] Betrán AP, Ye J, Moller AB, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in caesarean section rates: global, regional and national estimates: 1990-2014. PLoS One 2016;11:e0148343.

[25] Santas G, Santas F. Trends of caesarean section rates in Turkey. J Obstet Gynaecol 2018;38:658–62.

[26] Gür EB, Turan GA, Tatar S, Oran N, Yüksel Yavuz M, Hepyılmaz İ. The overview of high cesarean section rate in Turkey through the eyes of obstetricians and midwives Turkiye Klinikleri. J Gynecol Obst 2014;24:71–9.

[27] Küçük M. Defensive medicine among obstetricians and gynecologists in Turkey. J Obstet Gynaecol 2018;38:200–5.