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ORIGINAL ARTICLE

Born healthy or not?: Identifying socioeconomic determinants of low- & normal-birthweight in Turkiye

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Abstract

Background Birthweight is accepted as a critical parameter playing a role in neonatal health. It is widely suggested that low birthweight (LBW) has impacts not only on early childhood but also on further lifespan stages.

Aim This study aims to determine socioeconomic factors affecting low and normal birthweight (NBW) in Turkiye, using the data of the latest three waves of the Turkish Demographic Health Survey.

Methods The study uses multivariate linear regression design and logistic regression with its marginal effects in the analyses.

Results It is revealed that the prevalence of LBW has not changed significantly during the period of interest. Higher maternal education, higher levels of wealth, living in the developed parts of Turkiye, being male and singleton were associated with (i) decreases in the probability of having LBW and (ii) increases in the probability of having NBW. Although smoking was not significantly associated with LBW, it is found to be related to decreases in the probability of NBW. Interestingly, maternal age and the number of ANC visits seemed to be irrelevant to birthweight.

Conclusions This study revealed the socioeconomic variations that have potential to be prevented. It is important to develop policies to reduce these variations to contribute to neonatal health.

Keywords Birthweight · Normal birthweight · Low-birthweight · Socioeconomic determinants

Introduction

Birthweight is among the major indicators of neonatal health (Kramer 1987). Low birthweight (birthweight (BW) < 2500 g) has several short-term and long-term health outcomes at the population level (Fuster and Santos 2016; World Health Organization 2018; United Nations Children's Fund (UNICEF) and World Health Organization (WHO) 2019). It is one of the leading determinants of neonatal mortality and morbidity (OECD Stats 2022). It is reported that infants with LBW have a 40-fold increased risk of death compared to their normal birthweight counterparts (2500 g < BW < 4000 g). Moreover, the infants with very low birth weights (BW <1500 g) have a 200-fold greater risk of death in comparison with the same category (Nelson et al. 2002). LBW is associated with complications such as hypothermia, hypoglycaemia, perinatal asphyxia, respiratory distress, anaemia, impaired nutrition, infection, neurological trouble, and hearing deficits (Marlow et al. 2005; van Baar et al. 2005; Delobel-Ayoub et al. 2006; de Kieviet et al. 2009).

The prevalence of LBW is approximately 15% while 95% of the infants are born in developing countries (World Health Organization and UNICEF 2004). LBW is determined generally through genetic, socio-economic, and environmental factors (Kramer 1987; Hjalgrim et al. 2003; Harder et al. 2007). These factors are reported as the gender (Janjua et al. 2008), ethnicity (Tutkuviene et al. 2011), hemoglobin and blood pressure (Yadav et al. 2008), maternal education (Dasgupta and Basu 2011), maternal age (Mishra et al. 2021), socioeconomic status (Martinson and Reichman 2016), region (Dubois et al. 2007), smoking (Escartín et al.

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2014), parity (Islam and ElSayed 2015), type of pregnancy (Boulet et al. 2003), antenatal care (ANC) (Coria-soto et al. 1996), type of delivery (Wannous and Arous 2001; Islam and ElSayed 2015), malnutrition (Kader and Perera 2014), type of cooking fuel (Kadam et al. 2013), and air pollution (Lamichhane et al. 2020).

Various studies have been carried out globally to identify the major factors affecting LBW and high birthweight (i.e., macrosomia) (Boulet et al. 2003; Halileh et al. 2008; Kader and Perera 2014). On the other hand, studies investigating the factors regarding NBW (2500 g < BW < 4000 g) are limited (Ro et al. 2019). As for the studies conducted in Turkiye, they also have addressed the factors related to either LBW or macrosomia (Öçer et al. 1999; Hızel and Coşkun 2000; Oral et al. 2001). Therefore, this study aims to estimate the impacts of not only LBW but also of NBW. To the best knowledge of the authors, it is the first study investigating birthweight from different perspectives (i.e., low and normal birthweight) in Turkiye. In addition, the present study is novel owing to assessing a comparatively large population for a longer period.

Data and methods

This study uses the data of the latest three waves of Turkish Demographic and Health Surveys (TDHS), which were conducted in 2003, 2008, and 2013. TDHS is a nationally representative household survey that is repeated every five-years. It collects the retrospective information on health, socioeconomic, and demographic characteristics of ever-married women at reproductive age (15–49 years).

The TDHS consists of three components: the household questionnaire, the individual questionnaire, and the birth questionnaire. Based on the birth history of the mothers, a pooled sample of 8.075 participants from the 2003 TDHS, 7.405 from 2008, and 9.746 from 2013 was examined (TDHS 2003, 2008, 2013).

The analyses were limited to the last neonate due to the completeness of birthweight records in the household. For this purpose, previous births and the last births with unreported birthweight were excluded from the data sets. Accordingly, 993 observations in the 2003 wave, 516 observations in the 2008 wave, and 144 observations in 2013 were excluded. The sample of interest has 2.321 neonates from 2003 TDHS, 2.453 from 2008, and 2.699 from 2013. Using this sample of 7473 individuals, this study aims (i) to estimate the changes in the prevalence of LBW and NBW and (ii) to identify the socioeconomic factors affecting LBW and NBW in Turkiye.

The multivariate linear regression (OLS) and logistic regression designs were used to reveal socioeconomic determinants of the low and normal birthweight. The low and normal birthweight was considered as two separate binary outcomes. LBW measures the births of BW < 2500 g, while NBW measures the births of 2500 < BW < 4000 g. The models estimate the impacts of the factors, including the maternal education, wealth level of the family which is derived for each household considering ownership of assets, the region where the family lives, type of the pregnancy (singleton or multiple), gender of the neonate, parity (previous births), maternal age, smoking status, the number of the ANC, and caesarean section.

It is possible to show the OLS models in the study with the following formula:

$$Y_o = \beta + \beta_k X_k + u_i \tag{1}$$

According to the formula, Y_o stands for the outcome variables, in other words, the low birthweight *(LBW)* and normal birthweight *(NBW)*. β is the intercept, X_k is the independent variables, the number of factors k, which examines the effect on the LBW and NBW, the effect on the LBW and NBW is β_k, and finally, u_i shows the margin of error in the models.

In addition to OLS, logistic regression design was used to estimate socioeconomic determinants since the outcome variables are binary. Further, the marginal effects (ME) were obtained to compare with OLS coefficients. The logistic regression and its ME formulas can be written for the present study as follows:

$$P_i = \frac{1}{1 + \mathrm{e}^{-Z_i}} \tag{2}$$

where P_i is the probability of LBW (NBW), i.e., $Y_{LBW} = 1$ ($Y_{NBW} = 1$)

$$Z_i = BX + u_i \tag{3}$$

The probability of $Y_{LBW} = 0$, ($Y_{NBW} = 0$), that is, the neonate is not born with LBW, (NBW)

$$1 - P_i = \frac{1}{1 + e^{Z_i}} \tag{4}$$

Taking the ratio of Eqs. (3) and (4) gives the odds ratio in favor of LBW (NBW).

$$\frac{P_i}{1 - P_i} = \frac{1 + \mathrm{e}^{Z_i}}{1 + \mathrm{e}^{-Z_i}} = \mathrm{e}^{Z_i} \tag{5}$$

Taking the natural logarithm of Eq. (5), we obtain the log of odds ratio, i.e., ME. In this way, we have the linear function of LBW (NBW) in Eq. 6, which could be compared to OLS coefficients.

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = BX_i + u_i \tag{6}$$

As mentioned, LBW and NBW are measured by binary variables indicating whether the neonate is born with LBW

(or NBW) or not. Maternal education is measured by six categories where the lowest category has the individuals with no educational level; and the highest category includes the individuals who hold a master's degree or above. Wealth level of the family is measured by five categories varying from the lowest to the highest level. The region depicts where the family lives in Turkiye according to five categories (i.e., eastern, western, southern, middle, and northern). The type of pregnancy is a binary variable which is measured by singleton or multiple. Gender of neonate is also a binary variable that indicates being male or female. Parity and maternal age are continuous variables. Smoking status is measured as a binary variable indicating whether the mother smokes or not. Number of ANC visits is measured by three categories (i) $0 \leq$ ANC ≤ 2, (ii) $3 \leq$ ANC ≤ 6, and (iii) 7 or more. Caesarean section is a binary variable whether delivery is caesarean or not (i.e., vaginal). The descriptive statistics of the variables used in the models can be seen in Table 1, by years respectively.

Table 1 Descriptive statistics

Variables	2003				2008				2013			
	n	Mean	Min.	Max.	n	Mean	Min.	Max.	n	Mean	Min.	Max.
LBW	2321	0.105	0	1	2453	0.110	0	1	2699	0.101	0	1
NBW	2321	0.820	0	1	2453	0.811	0	1	2699	0.842	0	1
Maternal education												
Illiterate[a]	2321	0.083	0	1	2453	0.111	0	1	2699	0.120	0	1
Primary	2321	0.561	0	1	2453	0.531	0	1	2699	0.050	0	1
Secondary	2321	0.106	0	1	2453	0.111	0	1	2699	0.525	0	1
High school	2321	0.170	0	1	2453	0.172	0	1	2699	0.197	0	1
University	2321	0.039	0	1	2453	0.074	0	1	2699	0.100	0	1
Master's degree or above	2321	0.041	0	1	2453	0.001	0	1	2699	0rr120	0	1
Wealth												
Poorest[a]	2321	0.114	0	1	2453	0.186	0	1	2699	0.008	0	1
Poorer	2321	0.189	0	1	2453	0.242	0	1	2699	0.236	0	1
Middle	2321	0.206	0	1	2453	0.235	0	1	2699	0.247	0	1
Richer	2321	0.262	0	1	2453	0.150	0	1	2699	0.203	0	1
Richest	2321	0.230	0	1	2453	0.224	0	1	2699	0.165	0	1
Region												
Eastern of Turkiye[a]	2321	0.216	0	1	2453	0.368	0	1	2699	0.319	0	1
Western of Turkiye	2321	0.323	0	1	2453	0.142	0	1	2699	0.216	0	1
Southern of Turkiye	2321	0.155	0	1	2453	0.223	0	1	2699	0.147	0	1
Middle of Turkiye	2321	0.197	0	1	2453	0.117	0	1	2699	0.183	0	1
Northern of Turkiye	2321	0.109	0	1	2453	0.150	0	1	2699	0.135		
Type of pregnancy												
Multiple[a]	2321	0.010	0	1	2453	0.017	0	1	2699	0.019	0	1
Singleton	2321	0.990	0	1	2453	0.983	0	1	2699	0.981	0	1
Gender												
Male[a]	2321	0.529	0	1	2453	0.483	0	1	2699	0.466	0	1
Female	2321	0.471	0	1	2453	0.517	0	1	2699	0.534	0	1
Parity	2321	2.300	1	14	2453	2.350	1	12	2699	2.446	0	1
Maternal age	2321	26.57	13	47	2453	27.000	14	47	2699	28.036	0	1
Cigarette smoking	2321	0.201	0	1	2453	0.277	0	1	2699	0.205	0	1
ANC												
0–2	2321	0.249	0	1	2453	0.150	0	1	2699	0.081	0	1
3–6	2321	0.369	0	1	2453	0.331	0	1	2699	0.204	0	1
7 or more[a]	2321	0.383	0	1	2453	0.520	0	1	2699	0.715	0	1
Caesarean section	2321	0.306	0	1	2453	0.409	0	1	2699	0.494	0	1

[a]Reference category

Results

LBW neonates comprised around 10% of all waves, while neonates with NBW were approximately 80% (Table 1). Since the dependent variables in the models were binary, estimations of multiple logistic regressions and MEs were conducted in addition to OLS estimations. Accordingly, OLS and logistic regression models and ME estimations are presented in Tables 2 and 3, respectively.

As a result, the OLS and ME models identified that maternal education, wealth level of the family, region, singleton, gender, ANC, and caesarean section were associated with LBW. In contrast, parity, maternal age, and smoking seems to be ineffective on LBW for both models (Tables 2 and 3).

As for NBW, it was detected that maternal education, wealth level of the family, region, singleton, smoking, ANC, parity and caesarean section were associated with NBW. On the contrary, gender and maternal age were not related to NBW (Tables 2 and 3).

The LBW results (presented in Tables 2 and 3) revealed that increases in maternal education, compared with illiterate, were related to decreases in LBW (approximately 4–15%) each year. Similarly, it was determined that as the wealth level of the family increased the probability of LBW decreased 3–12%. In addition, living in western Turkiye, compared to eastern, yielded a decrease in the probability of LBW (nearly 3–4%) in both the OLS and ME models. Singleton was significantly found to decrease (45–50%) the

Table 2 OLS estimations of LBW and NBW by years

Variables	LBW			NBW		
	2003	2008	2013	2003	2008	2013
Maternal education						
Primary	–0.08**	–0.063**	–0.05	0.07*	0.09***	0.07
Secondary	–0.121***	–0.09***	–0.07***	0.112***	0.08**	0.084***
High school	–0.11**	–0.072**	–0.07**	0.1**	0.11***	0.093***
University	–0.111**	–0.142***	–0.102***	0.072	0.154***	0.1**
Master's degree or above	–0.154***	–0.18***	–0.090	0.204***	0.244***	0.11
Wealth						
Poorer	–0.042	–0.027	–0.052***	0.018	–0.029	0.055**
Middle	–0.092***	–0.054**	–0.062***	0.078**	0.018	0.06**
Richer	–0.1***	–0.047**	–0.07***	0.077**	–0.002	0.063**
Richest	–0.117***	–0.045*	–0.066***	0.083**	–0.03	0.07**
Region						
Western of Turkiye	–0.036**	–0.041**	–0.016	0.057**	0.052**	0.026
Southern of Turkiye	0.004	–0.037*	–0.035*	–0.0	0.011	0.045**
Middle of Turkiye	–0.036*	–0.025	–0.016	0.036	0.039*	0.023
Northern of Turkiye	–0.037*	–0.022	0.018	0.038	–0.005	0.023
Type of pregnancy						
Singleton	–0.48***	–0.48***	–0.47***	0.393***	0.385***	0.401***
Gender						
Female	0.031**	0.044***	0.017	0.005	0.008	0.0
Parity	0.0	–0.009	0.001	–0.024***	–0.014*	–0.008
Maternal age	–0.001	0.002	–0.002	0.002	–0.002	0.001
Cigarette smoking	0.009	0.015	0.024	–0.014	–0.021	–0.035*
ANC						
0–2	0.011	0.04*	0.041	0.009	–0.05*	–0.048
3–6	–0.036**	0.042***	0.022	0.05***	–0.045**	–0.024
Caesarean section	0.069***	0.047***	0.029**	–0.07***	–0.039**	–0.042***
Constant	0.781***	0.6***	0.71***	0.264**	0.471***	0r326***
Observations	2321	2453	2699	2321	2453	2699
R^2	0.08	0.078	0.082	0.059	0.053	0.057
F-value	6.42	8.85	6.54	6.34	19.77	5.48

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 3 Logistic regression and its marginal effects estimations of LBW and NBW by years

Variables	Logistic regression						Marginal effects					
	LBW			NBW			LBW			NBW		
	2003	2008	2013	2003	2008	2013	2003	2008	2013	2003	2008	2013
Maternal education												
Primary	–0.509**	–0.477**	–0.318	0.314	0.458***	0.365	–0.04**	–0.04**	–0.021	0.044	0.067***	0.04
Secondary	–1.151***	–0.818***	–0.575***	0.692**	0.418*	0.501***	–0.061***	–0.052***	–0.045***	0.078***	0.054**	0.063***
High School	–0.963**	–0.562*	–0.592**	0.602**	0.651***	0.608***	–0.057***	–0.04**	–0.039**	0.072***	0.082***	0.066***
University	–0.944*	–1.856***	–1.259***	0.381	1.068***	0.657**	–0.05**	–0.085***	–0.065***	0.046	0.114***	0.067***
Master's degree or above	–2.111**	0.0	–0.906	1.977***	0.0	0.762	–0.077***	0.0	–0.048	0.146***	0.0	0.072
Wealth												
Poorer	–0.276	–0.217	–0.464***	0.078	–0.191	0.363**	–0.0194	–0.017	–0.032***	0.011	–0.029	0.042***
Middle	–0.808***	–0.537**	–0.65***	0.485**	0.139	0.433**	–0.051***	–0.039***	–0.042***	0.06***	0.02	0.049***
Richer	–0.912***	–0.474*	–0.803***	0.48**	–0.02	0.466**	–0.059***	–0.035**	–0.049***	0.061***	–0.003	0.052**
Richest	–1.2***	–0.403	–0.687**	0.522**	–0.243	0.514**	–0.071***	–0.03	–0.043***	0.065***	–0.037	0.056**
Region												
Western of Turkiye	–0.383*	–0.473**	–0.167	0.415***	0.384**	0.199	–0.027**	–0.035**	–0.012	0.054***	0.052**	0.024
Southern of Turkiye	0.041	–0.355	–0.89*	0.003	0.058	0.345*	0.003	–0.026*	–0.026**	0.0	0.008	0.039**
Middle of Turkiye	–0.403*	–0.281	–0.159	0.246	0.271*	0.166	–0.028**	–0.022	–0.012	0.032	0.037*	0.02
Northern of Turkiye	–0.414	–0.196	–0.2	0.247	–0.049	0.181	–0.027*	–0.015	–0.014	0.032	–0.007	0.021
Type of pregnancy												
Singleton	–2.571***	–2.643***	–2.664***	1.835***	1.804***	1.987***	–0.453***	–0.485***	–0.473***	0.385***	0.385***	0.403***
Gender												
Female	0.364**	0.491***	0.193	0.039	0.06	0.003	0.028**	0.041***	0.014	0.005	0.009	0.0
Parity	0.009	–0.093	0.02	–0.133***	–0.072*	–0.049	0.001	–0.008	0.001	–0.018***	–0.01*	–0.006
Maternal age	–0.018	0.025	–0.027	0.013	–0.017	0.01	–0.001	0.002	–0.002	0.002	–0.002	0.001
Cigarette smoking	0.109	0.169	0.281*	–0.1	–0.149	–0.271**	0.008	0.014	0.023	–0.014	0.022	–0.036**
ANC												
0–2	0.058	0.462**	0.395*	0.073	–0.356**	–0.336*	0.004	0.043*	0.034	0.01	–0.056*	–0.046
3–6	–0.462**	0.475***	0.25	0.371***	–0.327**	–0.193	–0.033**	0.042***	0.02	0.049***	–0.049***	–0.025
Caesarean Section	0.77***	0.529***	0.354***	–0.491***	–0.277**	–0.346***	0.067***	0.045***	0.027**	–0.072***	–0.041**	–0.043***
Constant	1.994**	0.253***	1.715***	–1.245**	0.116	–0.994**						
Observations	2.321	2.453	2.699	2.321	2.453	2.699						
Pseudo R^2	0.101	0.09	0.093	0.059	0.05	0.055						

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$=

probability for LBW in all models. Being female, compared with being male, increased probability by almost 5% for LBW in 2003 and 2008. According to all models, parity and maternal age was insignificant in LBW. In addition, smoking was surprisingly not associated with LBW models. In terms of ANC, 3–6 visits were negatively related to LBW in 2003 compared with 7 or more visits, but positively associated with LBW in 2008 in both models. All estimations revealed that caesarean section was also positively associated with LBW in all years (Tables 2 and 3).

As for NBW, it is found that increasing maternal education is associated with increasing probability of NBW in all models where such increase varies from 5% to 25% as the level of maternal education increased. In addition, it was detected that increasing wealth of the family, increases the probability of NBW by 4–8%. Living in the developed part of Turkiye, compared to the developing (or underdeveloped one), brought about an increase in the probability of LBW (approximately 4–6%) in all models. It was understood that singleton was related to NBW with increased probability (almost 40%) when multiple births were the reference. Gender was not significant in NBW models. As the parity increased, except for 2013, the probability of NBW decreased. A one-unit increase in parity corresponded to a roughly 2% decrease in the probability of NBW in 2003. It was determined that maternal age was not significant on LBW and NBW according to all models. On the other hand, smoking was related to a decrease in NBW probability in 2013 (nearly 3.5%). It was determined that 3–6 visits were positively associated with NBW in 2003 compared with 7 or more visits while it was negatively associated with NBW in 2008. Finally, caesarean section was negatively associated with NBW (Tables 2 and 3).

Discussion

This study investigated socioeconomic determinants of LBW and NBW in Turkiye using the secondary data of THDS from 2003 to 2013 (TDHS 2003, 2008, 2013). It is understood that the prevalence of LBW was approximately 10%, while the prevalence of NBW was almost 80% in all waves. Accordingly, it is observed that the prevalence of LBW has not changed significantly over time. The findings confirm the previous literature (World Health Organization and UNICEF 2004) suggesting LBW ratios of Turkiye close to developed societies.

This large and retrospective study detected that higher maternal education was related to (i) decreases in the probability of LBW and (ii) increases in the probability of NBW, which is consistent with some studies (Dasgupta and Basu 2011; Islam and ElSayed 2015; Martinson and Reichman 2016). It may be because educated mothers have better awareness and skills such as neonate care practices, healthy lifestyles, health facilities, and ANC services.

The results of this study also indicated that higher wealth level of the family was related to (i) decreases in the probability of LBW and (ii) increases in the probability of NBW. The finding is consistent with some studies reporting that birthweight is statistically affected by familial wealth (Islam and ElSayed 2015; Martinson and Reichman 2016). The motivation behind this result might be that increasing the level of wealth facilitates adequate and balanced nutrition during pregnancy and access to quality antenatal visits (Joelmedewase et al. 2019).

The findings also revealed that, compared to the developing (or underdeveloped part) of Turkiye, especially living in the developed parts (i) reduced the probability of LBW but (ii) increased the probability of NBW. The underlying reason for this result might be related to both cultural or developmental factors since Turkiye consists of both well-developed parts in the western and relatively less developed (or developing) parts in the eastern with different cultures. This result is consistent with previous studies (Dubois et al. 2007; Blencowe et al. 2019), especially for the cases of developed parts.

Singleton, compared to multiple, reduced the probability of LBW; on the other hand, it increased the probability of NBW. Previous studies have found similar results (Wannous and Arous 2001; Islam and ElSayed 2015). Nutritional deficiency may be shown as the cause of LBW risk in multiple births compared to singletons (Kramer 1987; Wannous and Arous 2001).

Being female, compared to male, also increased the probability of LBW in this study, which is consistent with the findings reported by different studies (Kramer 1987; Hızel and Coşkun 2000; Janjua et al. 2008; Escartín et al. 2014). The reason for the gender difference in birthweight may be related to the fact that the woman expecting a baby boy stores more energy metabolically (Halileh et al. 2008). It is also stated that the metabolic difference between expecting a boy or a girl leads to such a situation (Voldner et al. 2009).

This study also found that parity decreased the probability of NBW but did not statistically affect LBW. This result is consistent with a study conducted in Iran (Rafati et al. 2005) but inconsistent with some of the previous studies (Wannous and Arous 2001; Granado 2006). The parity effect on birthweight could be a result of the birth interval as well (Kramer 1987; Wannous and Arous 2001).

A significant association between maternal age and the probability of LBW and NBW was not detected in this study, which confirms the previous studies (Janjua et al. 2008; Escartín et al. 2014). Contrary to expectations, smoking was not significantly associated with LBW. Hızel and Coskun (2000) and Voldner et al. (2009) report supporting results of this finding. On the other hand, it was found that smoking related to a decrease in the probability of NBW. The result of this study has been supported by the findings of Martinson

(2016) and Dubois (2007). The reason may be the fact that smoking, especially during pregnancy, restricts the growth of the foetus (Boulet et al. 2003).

In this study, consistent findings could not be found for the number of ANC visits. It has been reported that no effect of ANC numbers on birthweight is detected in previous studies (Manyeh et al. 2016; Naim et al. 2020). It is reported that the quality of the ANC is more important than the number, thus it is known that quality and adequate visits are crucial for the health of the neonate (Nair et al. 2000).

Caesarean sections were positively associated with LBW in all years but negatively associated with NBW, which confirms the studies conducted by Boulet (Boulet et al. 2003) and Stanek (Stanek et al. 2020). It is understood that caesarean deliveries occur more often in LBW cases.

Conclusion

LBW is one of the leading indicators of healthy infancy and childhood. The effects of LBW on neonatal health are not only related to growth, cognition and disability; it also impacts other childhood outcomes.

In this study, it was found that LBW and NBW have significant associations with several socioeconomic explanatory variables across different years. This study revealed that LBW was highly associated with maternal education, wealth level of the family, region where the family lives, type of pregnancy (singleton), gender (female), ANC, and caesarean section. In addition to these factors, parity and cigarette smoking were significantly associated with NBW.

As far as we know, this is the leading study conducted in Turkiye, in terms of a considerably large sample and long study period, compared with previous studies. In addition, both LBW and NBW cut-off for birthweight were tested, while a substantial number of previous studies on birthweight have focused on LBW and/or macrosomia. This study considered both possible conditions in birthweight. On the other hand, this study was carried out only on the last neonate birthweight because of the lack of data on all births.

As a result, it is understood that many variations of the socioeconomic determinants of birthweight (either low or normal) (e.g., maternal education, wealth level of the family, region, parity, cigarette smoking, and ANC) are preventable. Tackling the variations of these determinants is crucial for policy makers. Therefore, the policies to be developed about these variations of socioeconomic factors will contribute to (i) reducing the negative effects of preventable factors on neonate health and (ii) improving public health indirectly.

Author contribution The authors contributed to the study's conception and design. Data processing and analysis were performed by all. The first draft of the manuscript was written by Hakan Degerli and all authors commented on previous versions of the manuscript. Hasan Giray Ankara revised the paper before submission. All authors read and approved the final manuscript.

Declarations

Ethical approval This is a retrospective study and therefore, no ethical approval is required. However, the necessary permissions to use the data were obtained from the DHS Program which is the provider of data sets.

Consent to participate Not applicable as it is a retrospective anonymised study.

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