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Impact of refugee status and maternal age on pregnancy outcomes: a comparative study from Turkiye

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ABSTRACT

Aims: This study aimed to elucidate sociodemographic, obstetric, and neonatal outcomes among Syrian refugee and native Turkish adolescents compared with adult women, to determine whether adverse maternal and neonatal outcomes are primarily attributable to young maternal age or exacerbated by Syrian refugee status.

Methods: This retrospective cohort study analyzed 23,832 deliveries at a tertiary care center in Turkiye's state-funded healthcare system from January 2015 to December 2018, with 5,720 singleton pregnancies meeting inclusion criteria. The study population comprised 2,235 adolescent pregnant women aged 15-19 years (985 Syrian refugees and 1,250 Turkish natives) and 3,485 adult pregnant women aged 20-35 years. Sociodemographic characteristics, obstetric and neonatal outcomes were compared between the groups.

Results: Refugee adolescents were younger, had a lower body mass index, insufficient weight gain during pregnancy and had inadequate antenatal care compared to other groups ($p<0.001$). Smoking and being unmarried were more prevalent among native adolescents ($p<0.001$), however the illiteracy rate was significantly higher among refugee adolescents ($p<0.001$). First- and second-trimester prenatal screening tests uptake was lower among refugee adolescents, but gestational diabetes mellitus (GDM) screening rates were higher ($p<0.001$). The cesarean delivery rate was higher among adult pregnant women, while vaginal deliveries were more common among refugee adolescents ($p<0.001$). Refugee adolescents experienced higher rates of pre-eclampsia and preterm birth, whereas GDM was more prevalent among adults ($p<0.001$).

Conclusion: Adolescent pregnancy is associated with significant maternal and neonatal health risks, exacerbated among Syrian refugee adolescents due to socioeconomic disparities, language barriers, limited education, and limited access to healthcare facilities. Targeted interventions are urgently needed to improve antenatal care and provide comprehensive education on fertility and reproductive health, support family planning, and prevent child marriage.

Keywords: Adolescent pregnancy, adverse pregnancy outcomes, antenatal care, health disparities, native adolescents, refugee adolescents

INTRODUCTION

Adolescence, a critical transition from childhood to adulthood marked by significant psychological and social changes, encompasses approximately 17% of the global population.[1] The World Health Organization (WHO) defines adolescent pregnancy as occurring in females aged 10-19 years, with those aged 10-14 classified as younger adolescents.2 According to the WHO, as of 2019, approximately 21 million adolescent pregnancies occurred annually among women aged 15-19 in developing countries, with 50% being unintended and resulting in an estimated 12 million live births.2 Despite the steady decline in the adolescent fertility rate over the past two decades, it remains at 11.6%, with significant regional disparities, particularly in low- and middle-income countries.[2,3]

According to the Turkish Demographic and Health Survey, 3.5% of adolescents in Turkiye had given birth, 1.5% had been married before the age of 15, and 0.2% had delivered a child before reaching that age.[4] However, a study conducted in seven hospitals across Turkiye between 2015 and 2017 reported that 7.9% of all births occurred during adolescence.[5] Although pregnancy- and childbirth-related complications remain the leading causes of death among adolescents in the region, adolescent pregnancy has not been directly identified as a cause of maternal mortality in Turkiye.[6,7]

Adolescent pregnancy is associated with significant physical and psychological challenges that adversely affect maternal and neonatal health.[8] Research indicates that pregnant adolescents face an increased risk of complications, including anemia, nutritional deficiencies, inadequate weight gain, spontaneous abortion, preterm birth, pre-eclampsia, birth trauma, and various labor interventions.[9] Moreover, adolescent mothers exhibit higher rates of postpartum complications, such as

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hemorrhage, postpartum depression, and challenges related to urinary, sexual, and breastfeeding health.[10] Neonates born to adolescent mothers are also at an increased risk of adverse outcomes, including prematurity, low birth weight, meconium aspiration, respiratory distress syndrome, hypoglycemia, jaundice, and mortality.[11]

According to the United Nations High Commissioner for Refugees, approximately 27.1 million refugees were recorded worldwide as of mid-2021, with 83% hosted in low- and middle-income countries.[12] Syria constitutes the largest source of refugees, representing 27% of the global refugee population, while Turkiye hosts the highest number, with 3.8 million individuals.[12] Data from the Turkish Presidency for Migration Management indicate that 47.6% of Syrian refugees in Turkiye are women, and 18.8% are adolescent girls aged 10-18 years.[13]

In addition to biological immaturity, pregnant adolescents particularly those from vulnerable populations such as refugees, are at increased risk of adverse maternal and neonatal outcomes.[14] These outcomes are exacerbated by distinct social challenges, including linguistic barriers, low educational attainment or illiteracy, legal constraints, inadequate nutrition and limited access to healthcare services.[15,16] These factors influence pregnancy outcomes to varying degrees, prompting ongoing discourse regarding the relative contributions of sociodemographic and economic determinants compared to intrinsic age-related risks.

This study aimed to elucidate maternal, obstetric, and neonatal outcomes among Syrian refugee and native Turkish adolescents (15-19 years) compared with adult women (20-35 years). It addressed the following research questions: 1. How does adolescent pregnancy influence maternal health outcomes? 2. How does adolescent pregnancy affect neonatal health outcomes? 3. How does refugee status among adolescents impact maternal and neonatal outcomes? 4. Are adverse outcomes in refugee adolescents primarily attributable to young maternal age or exacerbated by socio-environmental factors?

METHODS

Ethics

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Etlik Zübeyde Hanım Women's Health Training and Research Hospital Clinical Researches Ethics Committee (Date: 25.08.2021, Decision No: 2012/88). Due to the retrospective nature of the study, the local ethics committee waived the requirement for informed consent.

Study Design and Eligibility Criteria

This retrospective cohort study analyzed 5,720 singleton pregnancies among women aged 15-35 years who underwent antenatal assessments and delivered at a tertiary care center within Turkiye's state-funded healthcare system between January 2015 and December 2018. Participants were categorized into two groups based on maternal age at delivery; the adolescent group (15-19 years) and the adult group (20-35 years). The adolescent group was then subdivided into two subgroups: refugee adolescents and native adolescents. Patients with incomplete data, multiple gestations, or pre-existing systemic diseases were excluded from the analysis.

Data Collection and Assessment Criteria

All data were obtained from the hospital's electronic database and patient medical records. Information was collected on sociodemographic and maternal antenatal characteristics, including age, educational level, marital status, type of marriage (formal or religious), pre-pregnancy body-mass index (BMI), parity, gestational weight gain, frequency of antenatal follow-up visits, and rates of iron, folic acid, and vitamin D supplementation. Hemoglobin (Hb) and hematocrit (Hct) levels were assessed at the time of admission for delivery. Gestational age was determined based on the last menstrual period and confirmed by fetal crown-rump length measured via ultrasonography between 11 and 14 weeks of gestation.[17] The first-trimester combined screening test was performed between 11 and 14 weeks, while the second-trimester triple screening test was conducted between 16 and 20 weeks of gestation.[18] Hyperemesis gravidarum was defined as persistent nausea and vomiting accompanied by positive urinary ketones on urinalysis and a weight loss exceeding 5% of pre-pregnancy body weight.

Obstetric outcomes, including type of delivery, indications for cesarean delivery (CD), oligohydramnios and polyhydramnios, were evaluated.[19,20] Pre-eclampsia and eclampsia were diagnosed according to the guidelines of the American College of Obstetricians and Gynecologists.[21] All participants underwent routine screening for gestational diabetes mellitus (GDM) between 24 and 28 weeks of gestation, with diagnoses made in accordance with the criteria of the American Diabetes Association.[22] Preterm delivery was defined as delivery before 37 completed weeks of gestation.[23] Premature rupture of membranes (PROM) was defined as the rupture of the membranes prior to the onset of uterine contractions, whereas preterm premature rupture of membranes (PPROM) referred to PROM occurring before 37 weeks of gestation.[24,25] Neonatal outcomes, including gestational age at birth, birth weight, neonatal intensive care unit (NICU) admission rates, and Apgar scores at 1 and 5 minutes, were recorded.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 28.0 (IBM Corporation, Armonk, NY, USA). Continuous variables were reported as mean±standard deviation (SD) for normally distributed data or as median (minimum-maximum) for non-normally distributed data. Categorical variables were presented as frequencies and percentages. Continuous variables that were normally distributed were assessed using one-way analysis of variance (ANOVA) and the independent-sample T test, while those that were not normally distributed were evaluated using the Kruskal-Wallis and Mann-Whitney U tests. Categorical variables were compared across three groups (native Turkish adolescents, Syrian refugee adolescents and adult women) using the Pearson Chi-squared test. Post-hoc pairwise comparisons were performed when significant differences were detected. Statistical significance was defined as a p-value <0.05.

RESULTS

The study analyzed 23,832 deliveries at the study hospital during the specified period, of which 5,720 met the inclusion criteria for live singleton pregnancies. Of these, 2,235 were pregnant adolescent women aged 15-19 (985 refugees and 1,250 natives), and 3,485 were pregnant adult women aged 20-35. Sociodemographic and antenatal characteristics of the study population are presented in Table 1. Refugee adolescents represented the youngest group, with a median age of 17 years (15-19), compared to 18 years (15-19) among native adolescents and 29 years (20-35) among adult women (p<0.001). Refugee adolescents exhibited lower pre-pregnancy BMI, inadequate gestational weight gain, significantly lower Hb and Hct levels, and attended fewer than four antenatal care visits (p<0.001). Active smoking and unmarried status were more common among native adolescents compared to refugee adolescents and adult women (p<0.001). Screening for GDM was more frequently performed among refugee adolescents (p<0.001), whereas participation in first-trimester combined screening and second-trimester triple screening tests was significantly lower in this group (p<0.001).

Obstetric characteristics and outcomes are presented in Table 2. Refugee adolescents had significantly higher rates of vaginal delivery (79.2%), while CD was more common among adult women (54.1%) (p<0.001). Emergency CD due to fetal distress was the most frequent indication among adolescents, while elective CD due to a history of previous CD was more common among adults (p<0.001). Pre-eclampsia was more prevalent among refugee adolescents than among native adolescents and adults (p<0.001). No statistically significant differences were observed between the groups in terms of hyperemesis gravidarum, eclampsia, postpartum hemorrhage, and polyhydramnios.

Neonatal outcomes are shown in Table 3. Refugee adolescents had a significantly lower gestational age at birth (38±4.5 weeks), lower birth weight (3089±246 grams), and a higher preterm birth rate compared with native adolescents and adults (21%, 17.7%, and 13.9%, respectively) (all p<0.001).

Table 1. Sociodemographic and antenatal characteristics of the study population

Variables	Refugee adolescents[1] (n=985)	Native adolescents[2] (n=1250)	Adults[3] (n=3485)	p-value	p-value (1 vs. 2)	p-value (1 vs. 3)	p-value (2 vs. 3)
Age (years) (min-max)	17 (15-19)	18 (15-19)	29 (20-40)	<0.001[c]	<0.001[a]	<0.001[a]	<0.001[a]
BMI (kg/m²) (mean±SD)	20.8±3.1	22.3±2.9	24.5±3.9	<0.001[d]	<0.001[b]	<0.001[b]	<0.001[b]
Education level (n, %)							
Uneducated	595 (60.4)	106 (8.5%)	110 (3.2%)				
Primary education	382 (38.8)	1125 (90%)	3275 (93.9%)	<0.0011	<0.0011	<0.0011	<0.0011
High school	8(0.8%)	19 (1.5%)	100 (2.9%)				
Marital status (n, %)							
Married	601 (61%)	655 (52.4%)	3242 (93%)	<0.0011	<0.0011	<0.0011	<0.0011
Single	384 (39%)	595 (47.6%)	243 (7%)				
Type of marriage (n, %)							
Formal	60 (10%)	104 (15.9%)	3005 (92.7%)	<0.0011	<0.0011	<0.0011	<0.0011
Religious	541 (90%)	551 (84.15)	237 (7.3%)				
Active smoking (n, %)	48 (4.9%)	225 (18%)	419 (12%)	<0.0011	<0.0011	<0.0011	<0.0011
Parity rate (mean±SD)	1.8±0.9	1.2±0.6	1.5±0.7	<0.001[d]	<0.001[d]	<0.001[d]	<0.001[d]
Parity (n, %)							
Nulliparous	325 (33.1%)	510 (40.8%)	974 (27.9%)	<0.0011	<0.0011	<0.0011	<0.0011
Multiparous	660 (66.9%)	740 (59.2%)	2511 (72.1%)				
Antenatal follow-up times (n, %)							
<4	455 (46.2%)	400 (32)	585 (16.8)	<0.0011	<0.0011	<0.0011	<0.0011
≥4	530 (53.8%)	850(68%)	2900 (83.2%)				
Weight gain during pregnancy (mean±SD)	8.45±4.50	10.35±3.45	12.97±3.69	<0.001[d]	<0.001[d]	<0.001[d]	<0.001[d]
Hemoglobin before birth (g/dl) (min-max)	10.48 (7.8-14.8)	11.05 (6.8-16.5)	11.85 (5.7-16.6)	<0.0011	<0.001[a]	<0.001[a]	0.062[a]
Hematocrit (mean±SD)	33.65±2.3	34.85±3.2	35.68±2.6	0.001[d]	0.025[d]	<0.001[d]	0.002[d]
Folic acid intake (n, %)	304 (30.9%)	765 (61.2%)	2750 (78.9%)	<0.0011	<0.0011	< 0.0011	<0.0011
Iron replacement therapy (n, %)	376 (38.2%)	1025 (82%)	2958 (84.9%)	<0.0011	<0.0011	<0.0011	<0.0531
Vitamin D supplementation (n, %)	245 (27.9%)	950 (74.4%)	2987 (85.7%)	0.0011	<0.0011	<0.0011	<0.0011
First-trimester combined test (n, %)	180 (18.3%)	325 (26%)	1680 (48.2%)	<0.0011	<0.0011	<0.0011	<0.0011
Second-trimester triple test (n, %)	122 (12.4%)	248 (19.8%)	848 (24.3%)	<0.0011	<0.0011	<0.0011	<0.0011
GDM screening test (<37 weeks) (n, %)	178 (18.1%)	156 (12.5%)	530 (15.2%)	<0.0011	<0.0011	<0.0011	<0.0011

min: Minimum, max: Maximum, BMI: Body-mass index, SD: Standard deviation, GDM: Gestational diabetes mellitus, [1]Pearson's Chi-square test statistics, [a]Mann-Whitney test, bindependent sample T test, [c]Kruskal-Wallis test, [d]One-way ANOVA test and a significant p-value is <0.05

Table 2. Maternal characteristics and obstetric outcomes

Variables	Refugee adolescents[1] (n=985)	Native adolescents[2] (n=1250)	Adults[3] (n=3485)	p-value	p-value (1 vs. 2)	p-value (1 vs. 3)	p-value (2 vs. 3)
Mode of delivery (n, %)							
Spontaneous vaginal	780 (79.2%)	761 (60.9%)	1601 (45.9%)	<0.001	<0.001	<0.001	<0.001
Cesarean delivery	205 (20.8%)	489 (39.1%)	1884 (54.1%)				
CD indications (n, %)							
Previous CD	46 (4.7%)	71 (5.7%)	324 (17.2%)	<0.001	<0.001	<0.001	<0.001
Fetal distress	69 (7%)	106 (8.5%)	180 (9.6%)				
CPD	53 (5.4%)	80 (6.4%)	95 (5%)				
Breech presentation	3 (1.5%)	7 (1.4%)	89 (4.7%)				
Others	34 (2.2%)	225 (17.1%)	1196(17.6%)				
Hyperemesis gravidarum (n, %)	30 (3%)	27 (2.7%)	109 (3.1%)	0.154	0.128	0.254	0.185
Pre-eclampsia (n, %)	97 (9.8%)	56 (4.5%)	226 (6.5%)	<0.001	<0.001	<0.001	<0.001
Eclampsia (n, %)	1 (0.1%)	1 (0.08%)	3 (0.09%)	0.775	0.257	0.458	0.653
GDM (n, %)	11 (1%)	14 (1.1%)	195 (5.6%)	<0.001	0.062	<0.001	<0.001
PPROM (n, %)	34 (3.5%)	40 (3.2%)	73 (2.1%)	<0.001	0.563	<0.001	<0.001
PROM (n, %)	20 (2%)	26 (2.1%)	80 (2.3%)	0.622	0.452	0.832	0.654
Postpartum hemorrhage (n, %)	3 (0.3%)	4 (0.32%)	10 (0.29%)	0.093	0.123	0.158	0.232
Oligohydramnios (n, %)	69 (7%)	86 (6.9%)	150 (3.5%)	<0.001	0.854	<0.001	<0.001
Polyhydramnios (n, %)	22 (2.2%)	35 (2.8%)	101 (2.9%)	0.675	0.753	0.563	0.853

CD: cesarean delivery, CPD: Cephalopelvic disproportion, GDM: gestational diabetes mellitus, PPROM: preterm premature rupture of membranes, PROM: premature rupture of membranes, Pearson's chi-square test was used for all comparisons and a significant p-value is <0.05.

Table 3. Neonatal outcomes of the study population

Variables	Refugee adolescents[1] (n=985)	Native adolescents[2] (n=1250)	Adults[3] (n=3485)	p-value	p-value (1 vs. 2)	p-value (1 vs. 3)	p-value (2 vs. 3)
Gestational age at birth (weeks) (mean±SD)	38±4.50	38.8±3.2	39.4±3.2	<0.001a	<0.001a	<0.001a	<0.001a
Preterm delivery (<37 weeks) (n, %)	207 (21%)	221 (17.7%)	485 (13.9%)	<0.0011	<0.0011	<0.0011	<0.0011
Birth weight (grams) (mean±SD)	3089±246	3260±631	3465±435	<0.001a	<0.001a	<0.001a	<0.001a
Low birth weight (<2500 grams) (n, %)	147 (14.9%)	123 (9.8%)	157 (4.5%)	<0.0011	<0.0011	<0.0011	<0.0011
Apgar score (<7 at 1st minute) (n, %)	71 (7.2%)	69 (5.5%)	181 (5.2%)	<0.0011	<0.0011	<0.0011	0.7541
Apgar score (<7 at 5th minute) (n, %)	29 (2.9%)	21 (1.7%)	66 (1.9%)	<0.0011	<0.0011	<0.0011	0.5421
Neonatal intensive care unit admission (n, %)	88 (8.9%)	101 (8.1%)	261 (7.5%)	<0.0011	<0.0011	<0.0011	<0.0011

SD: Standard deviation, 1Pearson's Chi-square test statistics, aKruskal-Wallis test and a significant p-value is <0.05.

DISCUSSION

According to the WHO, adolescent pregnancies constitute approximately 11% of global births, predominantly occurring in low- and middle-income countries.2 Approximately 50% of these pregnancies are unintended, often leading to unsafe abortions or neglected antenatal care.[26] Due to biological immaturity and insufficient antenatal care, adolescents face elevated risks of adverse obstetric outcomes, rendering adolescent pregnancy a critical global public health concern.[27] The Syrian civil war has exacerbated these challenges, with millions of refugee adolescents encountering economic, social, and linguistic barriers, as well as limited access to healthcare facilities in host countries.[28,29]

Adequate antenatal care is essential for reducing maternal and perinatal morbidity and mortality by directly detecting and managing complications and identifying women at risk during labor and delivery.[30] The Republic of Turkiye has established a state-funded healthcare system for Syrian refugees, providing access to health facilities beyond refugee camps. Within this framework, pregnant refugees receive free antenatal care, including vitamin and iron supplementation, in accordance with the Ministry of Health's routine antenatal care guidelines, which recommend a minimum of four follow-up visits for low-risk pregnancies.[31] Despite sustained efforts, significant gaps in antenatal care uptake have persisted over the past 15 years, particularly among Syrian refugee adolescents. In our study, 46.2% of refugee adolescents attended fewer than four antenatal follow-up visits, compared to 68.0% of native adolescents and 83.2% of adult women who completed four or more visits. Similarly, Erenel et al.[32] reported that 41.3% of pregnant Syrian refugees received no antenatal care.

Furthermore, illiteracy significantly exacerbated barriers to antenatal care access, with 60.4% of refugee adolescents illiterate compared to 8.5% of native adolescents and 3.2% of adult women (p<0.001), aligning with high illiteracy rates among Syrian refugees reported by Demirci et al.[33]

Our results revealed significant differences in prenatal screening rates. Prenatal aneuploidy screening uptake was significantly lower among refugee adolescents, with 18.3% completing the first-trimester combined test and 12.4% the second-trimester triple test (p<0.001), consistent with rates of 16.5% and 11.9%, respectively, reported by Golbasi et al.[29] In contrast, their participation in GDM screening was notably higher. This disparity may be attributed to cultural influences, as some Turkish women reportedly decline GDM testing due to misconceptions regarding the safety of glucose loading and its potential risks to infants. These findings indicate that, beyond structural barriers, cultural attitudes and levels of health literacy significantly shape screening behaviors.[34]

Child marriage, a prevalent issue among Syrian refugees, contributes to early childbearing and elevated adolescent pregnancy rates. UNICEF reported a rise in child marriage among Syrian refugees in Jordan from 18% in 2012 to 32% in 2014, compared to 13% pre-conflict in Syria.[35,36] While child marriage was an accepted cultural practice in Syria prior to the crisis, the subsequent economic collapse and the inability to afford education or secure employment have intensified this practice. It is often seen as a socially acceptable strategy for achieving economic stability in host countries. Furthermore, refugee adolescents frequently have limited knowledge of family planning and lack the health literacy necessary to use contraceptives effectively.[37] As a result, and consistent with previous research,[29,33] our findings demonstrated that refugee adolescents had a lower maternal age (17 years) and a higher parity rate (1.8±0.9) compared to native adolescents (18 years, 1.2±0.6) (p<0.001).

Preterm birth, affecting approximately 13 million infants annually, is a multifactorial complication extensively studied globally.[38] The current literature presents conflicting evidence regarding preterm birth risk among adolescents aged 15-19 years, with some studies reporting elevated risk compared to adult women,[39] while others find no statistically significant difference.[40] Biological factors, including low maternal age, immature uterine development, short cervical length (<25 mm), progesterone dysregulation and anemia associated with nutritional deficiencies, have been identified as contributors to this risk.[41] Moreover, beyond biological immaturity, sociodemographic determinants, including marital status, poverty, and limited access to antenatal care further exacerbate the likelihood of preterm birth among adolescents.[9,10] Consistent with prior literature, this study demonstrated a significantly higher rate of preterm birth among refugee adolescents (21%) compared to native adolescents (17%) (p<0.001).

Furthermore, newborns of refugee adolescents exhibited significantly lower birth weights, reduced 1st- and 5th-minute Apgar scores, and higher rates of NICU admission compared to those of native adolescents and adults (p<0.001). These adverse outcomes may be attributed to multiple factors, including preterm birth, inadequate supplementation with essential vitamins and iron, and maternal psychological distress such as post-traumatic stress disorder. Prior research has established associations between micronutrient deficiencies, maternal mental health conditions, and adverse neonatal outcomes.[42,43]

This study demonstrated pronounced disparities in CD rates by maternal age and refugee status, with significantly higher rates observed among adult women (54.1%) compared to native adolescents (39.1%) and refugee adolescents (20.8%) (p<0.001). Consistent with previous studies,[33,44] the Turkish Demographic and Health Survey reported CD rates of 51.2% among adults and 33.3% among adolescents.4 Several hypotheses have been proposed to explain the lower CD rates in adolescents. Jolly et al.[45] suggested that enhanced myometrial contractility and greater connective tissue elasticity in adolescents facilitate spontaneous vaginal delivery. The higher rates of preterm birth among refugee (21%) and native adolescents (17.7%) compared to adults (13.9%) (p<0.001), along with significantly lower birth weights (3089±450 g and 3260±420 g vs. 3465±430 g, respectively; p<0.001), may contribute to the increased likelihood of vaginal delivery in adolescent groups. However, Zeteroğlu et al.[46] found no significant influence of biological immaturity on CD rates in a study of 40,391 pregnancies.

Beyond biological factors, socio-environmental barriers significantly influence obstetric outcomes among refugee adolescents. Prior literature identifies financial limitations, transportation difficulties, fear of mistreatment, security concerns, cultural stigma, limited availability of female healthcare providers and linguistic barriers as impediments to accessing antenatal care.[47,48] In line with these findings, the present study found significantly higher vaginal delivery rates among refugee adolescents (79.2%) compared to native adolescents (60.9%) and adult women (45.9%) (p<0.001). This disparity may reflect restricted access to elective or emergency CD interventions. Previous research has demonstrated that limited antenatal care and systemic obstacles in conflict-affected or refugee settings often hinder timely obstetric interventions.[49,50]

Pre-eclampsia, a major contributor to maternal and perinatal morbidity, poses heightened risks for adolescents. Current literature presents conflicting evidence, with some studies reporting an elevated pre-eclampsia risk in adolescents,[5,51] while others find no significant difference.[10,41,52] The pathogenesis of pre-eclampsia in adolescents may differ from that in older women, possibly linked to biological factors such as uterine immaturity that may contribute to defective deep placentation.[53,54] Moreover, Martinez et al.[55] reported higher prevalence rates of pre-eclampsia in adolescent pregnancies in low- and middle-income countries (11.5% and 10.6%, respectively) compared to the global estimate of 6.7%, with lower rates in very high-income countries (5.1%). Consistent with existing literature, this study identified a significantly higher pre-eclampsia rate among refugee adolescents (9.8%) compared to native adolescents (4.5%) and adult women (6.5%) (p<0.001). This disparity may be partially attributed to maternal vitamin D and iron deficiencies, compounded by barriers to antenatal care and limited health literacy.[56,57]

Previous studies have established associations between micronutrient deficiencies and increased pre-eclampsia risk.[58]

This study has several critical strengths that substantially advance the current understanding of adolescent pregnancy outcomes in low- and middle-income contexts, particularly among refugee populations. First, the large, well-characterized cohort of 5,720 singleton pregnancies, drawn from a total of 23,832 deliveries, includes three analytically distinct subgroups: Syrian refugee adolescents, native Turkish adolescents, and adult women. This design provides sufficient statistical power to detect clinically meaningful differences in obstetric and neonatal outcomes. Second, the study's comparative framework enables the disentanglement of the effects of age and refugee status within Turkiye's universal, state-funded healthcare system-an important context given Turkiye's status as host to the world's largest refugee population. Third, the inclusion of comprehensive sociodemographic, obstetric, and neonatal outcomes addresses critical gaps in understanding the interplay of biological and socio-environmental factors. Finally, this study addresses a critical gap in global reproductive health literature by focusing on refugee adolescents, a high-risk, understudied population, thereby elucidating how socioeconomic vulnerabilities exacerbate biological risks, providing evidence-based insights for targeted maternal health interventions in humanitarian contexts.

Limitations

Several important limitations of this study should be acknowledged. Its retrospective design may have resulted in incomplete data and limits the ability to draw causal inferences. Using data from a single tertiary care center, which typically manages high-risk pregnancies, may have introduced selection bias, potentially inflating rates of adverse outcomes. Furthermore, access to comprehensive antenatal services within Turkiye's high-resource public healthcare system may have attenuated some adverse outcomes, thereby limiting the detection of disparities. Unmeasured confounders, such as psychosocial stressors, restrict the ability to fully quantify or explore the mechanisms underlying the observed outcomes. Additionally, the findings may have limited generalizability to other refugee populations or healthcare systems with differing capacities. Prospective, multicenter studies incorporating mixed-methods approaches are needed to identify optimal interventions for adolescent pregnancies, particularly among vulnerable refugee populations.

CONCLUSION

Adolescent pregnancy among refugee populations presents significant risks to maternal and neonatal health due to compounded biological and social vulnerabilities. Our findings highlight the critical need for integrated, culturally sensitive healthcare strategies that transcend clinical management to address these challenges. First, enhancing antenatal care accessibility through community-based outreach, mobile health units, and interpreter services is essential to minimizing delays in care. Second, comprehensive reproductive health education tailored to adolescents and their families must be prioritized to address misconceptions and promote informed decision-making regarding contraception and family planning. Third, policy frameworks should ensure equitable healthcare coverage for refugee adolescents by reducing financial and structural barriers through national insurance schemes and cross-sector collaborations. Additionally, policymakers should support prospective multicenter studies and systematic evaluations of interventions to inform evidence-based strategies. Addressing adolescent pregnancy in refugee populations requires a dual clinical and policy approach, ensuring that both health outcomes and broader social determinants are improved in tandem.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Etlik Zübeyde Hanım Women's Health Training and Research Hospital Clinical Researches Ethics Committee (Date: 25.08.2021, Decision No: 2012/88).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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