Thieme

Teenage Pregnancies in Austria – an Epidemiological Study on Prevalence and Perinatal Outcome

Teenagerschwangerschaften in Österreich – eine epidemiologische Studie zu Häufigkeit und perinatalem Outcome

OPEN ACCESS

Authors
Julia Lastinger[1], Sabine Enengl[1], Sabrina Neururer[2], Hermann Leitner[2], Peter Oppelt[1], Patrick Stelzl[1]

Affiliations
1 Universitätsklinik für Gynäkologie, Geburtshilfe und Gynäkologische Endokrinologie, Kepler Universitätsklinikum, Johannes Kepler Universität Linz, Linz, Austria
2 Institut für klinische Epidemiologie der Tirol-Kliniken (IET), Landesinstitut für Integrierte Versorgung Tirol (LIV), Innsbruck, Austria

Key words
teenage pregnancies, adolescence, pregnancy outcome, Austria, risk factors

Schlüsselwörter
Teenagerschwangerschaften, Adoleszenz, Schwangerschafts-Outcome, Österreich, Risikofaktoren

received 24.3.2022
accepted after revision 26.7.2022
published online 25.10.2022

Bibliography
Geburtsh Frauenheilk 2023; 83: 212–219
DOI 10.1055/a-1911-1996
ISSN 0016-5751

Georg Thieme Verlag KG, Rüdigerstraße 14,
70469 Stuttgart, Germany

Correspondence
DDr. Patrick Stelzl
Universitätsklinik für Gynäkologie, Geburtshilfe
und Gynäkologische Endokrinologie
Kepler Universitätsklinikum, Johannes Kepler Universität Linz
Altenberger Straße 69
4040 Linz, Austria
patrick.stelzl@kepleruniklinikum.at

Deutsche Version unter:
https://doi.org/10.1055/a-1911-1996.

ABSTRACT

Introduction Even though teenage pregnancy rates have been declining in the last decades, their global prevalence is still high and shows country-specific discrepancies. Insufficient sexual education, poor availability of contraceptives and early marriage are some of the multifactorial causes for adolescent pregnancies. Very often teenage pregnancies are classified as high-risk pregnancies. Studies have found higher rates of peripartal complications, such as preterm birth, low birth weight or low fetal Apgar-Scores. The aim of this retrospective cohort study is to evaluate the prevalence of teenage pregnancies in Austria and to identify principal differences in maternal and neonatal outcome.

Material and methods Data were collected from the Austrian Birth Registry between 01/2012 and 12/2020. A total of 751 661 deliveries in Austria were documented. Obstetric, maternal and neonatal parameters were descriptively analyzed. Mothers were subclassified into two age groups: teenage mothers of 19 years and younger and adult mothers of 20 to 39 years of age.

Results Newborns of teenage mothers were significantly smaller (49.98 ± 3.11 vs. 50.31 ± 3.16 cm, $p < 0.001$) and had a lower birth weight (3216 ± 564 vs. 3247 ± 576 g, $p < 0.001$) than newborns of adult mothers. The percentage of caesarean deliveries in the teenage group was significantly lower than in adult mothers (21.1 vs. 31.8 %, $p < 0.001$). Newborns of teenage mothers had significantly higher rates of very low (< 4) and low (< 7) 5-minute Apgar scores (5-minute Apgar < 4: 0.75 vs. 0.54 %, $p = 0.004$) (5-minute Apgar < 7: 1.77 vs. 1.37 %, $p = 0.001$) and significantly lower arterial umbilical-cord pH (7.25 ± 0.08 vs. 7.26 ± 0.08, $p < 0.001$). Perinatal mortality was higher in the age group below 20 years (0.7 vs. 0.6 %, $p = 0.043$).

Conclusion The data of this study show significantly poorer outcomes in pregnancies of teenagers compared to adult women, even though the healthcare system in Austria is considered excellent. Future guideline recommendations should focus on important aspects of obstetric care in teenage mothers.

ZUSAMMENFASSUNG

Einleitung Schwangerschaften im Teenageralter haben weltweit, trotz insgesamt rückläufiger Zahlen, eine relativ hohe Prävalenz mit großem länderspezifischem Unterschied. Die Ursachen dafür sind multifaktoriell und reichen von mangelnder Sexualaufklärung über schlechte Verfügbarkeit von Verhütungsmitteln bis hin zu früher Heirat. Häufig werden Teenagerschwangerschaften als geburtshilfliche Risikokonstellation bezeichnet, da das vermehrte Auftreten von peripartalen Komplikationen wie Frühgeburten, niedriges Geburtsgewicht oder niedrige kindliche Apgar-Werte in der Literatur beschrieben wurde. Ziel dieser retrospektiven Kohortenstudie ist es, die Häufigkeit von Schwangerschaften im Jugendalter in Österreich zu evaluieren und Besonderheiten in Bezug auf das perinatale mütterliche sowie neonatale Outcome herauszuarbeiten.

Material und Methoden Mittels einer Abfrage aus dem österreichischen Geburtenregister konnten Daten von insgesamt 751 661 Geburten in Österreich im Zeitraum 01/2012 bis 12/2020 für die deskriptive Analyse herangezogen werden. Es wurden maternale, neonatale und geburtshilfliche Parameter ausgewertet. Die Mütter wurden in 2 Alterskategorien unterteilt: Schwangere ≤ 19 Jahre und erwachsene Schwangere zwischen 20 bis 39 Jahren.

Ergebnisse Die Neugeborenen der Teenagermütter waren signifikant kleiner (49,98 ± 3,11 vs. 50,31 ± 3,16 cm, $p < 0,001$) und hatten ein geringeres Geburtsgewicht als jene der erwachsenen Mütter (3216 ± 564 vs. 3247 ± 576 g, $p < 0,001$). Die Sectiorate war in der Gruppe der jungen Mütter etwa um ein Drittel niedriger als in der Gruppe der erwachsenen Schwangeren (21,1 vs. 31,8 %, $p < 0,001$). Die Neugeborenen der Teenagermütter hatten signifikant häufiger einen sehr niedrigen (< 4) und niedrigen (< 7) Apgar-Wert nach 5 Minuten (5-Minuten-Apgar < 4: 0,75 vs. 0,54 %, $p = 0,004$) (5-Minuten-Apgar < 7: 1,77 vs. 1,37 %, $p = 0,001$) und signifikant niedrigere arterielle Nabelschnur-pH-Werte (7,25 ± 0,08 vs. 7,26 ± 0,08, $p < 0,001$). Die perinatale Mortalität war bei den jüngeren Müttern höher (0,7 vs. 0,6 %, $p = 0,043$).

Schlussfolgerung Die vorliegenden Daten zeigen, trotz der ausgezeichneten Gesundheitsversorgung in Österreich, merkliche Unterschiede im Outcome von Schwangerschaften bei Teenagern im Vergleich zu erwachsenen Frauen. Durch die Erstellung von Beratungsempfehlungen und/oder Leitlinien sollte auf wichtige Aspekte in der geburtshilflichen Begleitung von jugendlichen Müttern aufmerksam gemacht werden.

Introduction

According to the World Health Organization (WHO), around 16 million girls between 15 and 19 years of age give birth every year [1]. From an international perspective, complications in the context of pregnancy and childbirth are the most common cause of death in adolescent girls [1, 2].

The WHO defines adolescence as the period from childhood to adulthood between 10 and 19 years of age [3]. Teenagers are young people from 13 to 19 years of age.

Although the highest number of teenage pregnancies occur in low-income countries, the causes and consequences of such pregnancies are of increasing scientific and political interest in high-income countries [4]. According to the European Perinatal Health Report 2015, Switzerland with 0.8 % was the European country with the lowest rate of pregnant women under 20 years of age, the highest rate was recorded with 10.2 % in Bulgaria [5]. In 2018, 1.3 % of all pregnant women in Finland and 9.1 % in Romania delivered between 15 and 19 years of age [6]. There has been a steady decline in the number of teenage pregnancies throughout Europe since 2001 [7]. Between 2012 and 2020, the number of deliveries among young women under the age of 20 almost halved in Austria, from 2.6 % of all deliveries in 2012 to 1.3 % in 2020 [8].

The most common causes of teenage pregnancies include poverty and a low level of education as well as early marriage, lack of sex education and the lack of availability of effective contraceptives [1, 2, 4, 9, 10].

In addition to social effects, pregnancies in adolescence are associated with increased maternal, obstetric and neonatal risks [1, 2, 9, 11, 12, 13, 14, 15]. However, deliveries of teenage mothers show significantly lower rates of caesarean sections and operative vaginal births [2, 16].

The literature reports higher preterm birth rates, lower birth weights and increased neonatal mortality in adolescent mothers [1, 12, 13, 14, 17]. In addition, an association was found between low 5-minute Apgar scores of newborns and young maternal age [13, 14, 15]. An increased incidence of hypertensive pregnancy disease in teenagers is discussed in some papers, but the data on this issue is inconsistent [12, 14, 18].

Furthermore, teenagers are at increased risk of acquiring sexually transmitted infections, which may lead to possible obstetric complications such as preterm premature rupture of the membranes (PPROM) with a signficantly increased risk for preterm birth, triple I and/or postpartum infections [2, 16]. The use of nicotine, alcohol or drugs during pregnancy is also observed more frequently in adolescent pregnant women than in adults [2, 13].

Most adolescent pregnancies are unplanned [1, 7, 13, 16]. In order to fully consider the number of teenage pregnancies, the rate of abortions in teenagers must also be discussed in more detail [7]. Mostly, live birth rates are fully recorded worldwide. However, the rate of termination of pregnancy is only recorded in a few countries and the unreported number of illegal abortions also plays a pivotal role. In Austria there is unfortunately no complete information on the number of abortions [4].

The aim of this retrospective cohort study is to investigate the frequency of teenage pregnancy and the differences between teenage and adult pregnancies in Austria (between 01/2012–12/2020) with regard to relevant obstetric outcomes. Based on the existing data, the hypothesis for this study was, that within the

study collective significant differences in neonatal outcome, delivery and preterm birth rates between both groups can be found.

Material and Methods

Austrian register of deliveries

In order to evaluate the frequency and obstetric outcome of teenage pregnancies in Austria, an application for special evaluation was submitted to the Austrian Register of Deliveries (Geburtenregister Österreich [GRÖ]). This register collects data on obstetric events in hospitals throughout Austria. The rights and obligations of the GRÖ are agreed in a contract between the clinic/department and the Institute for Clinical Epidemiology of the Tirol-Kliniken. In order to warrant data security, data of clinics/departments are only submitted in pseudonymized form (indirect personal data) to the GRÖ [19].

Data of 751 661 births and 11 809 deliveries of teenagers in Austria within the period 01/2012 to 12/2020 were available for data evaluation.

Inclusion and exclusion criteria

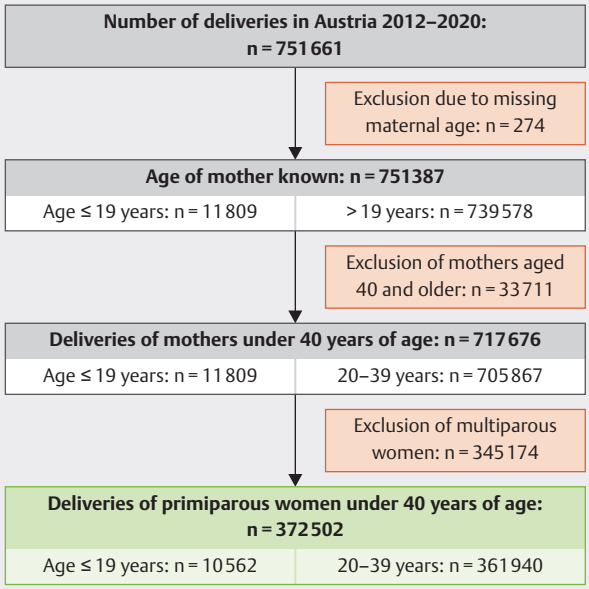
Included were only 372 502 primiparous, while 345 174 multiparous women were excluded. The mothers were divided into two age categories: 10 562 mothers ≤ 19 years and 361 940 older 20 to 39 years. 33 711 pregnant women aged 40 years and over were excluded (see ▶ **Fig. 1**).

Statistical analysis

Statistical analysis was performed by the GRÖ. Qualitative data are given as absolute (n) and relative (%) frequencies. Quantitative data are presented as median (interquartile range). The study groups were compared by using chi-square test (qualitative data) and Mann-Whitney U test (quantitative data, 2 groups). P values < 0.05 were considered statistically significant. All statistical analyses were performed using STATA 13 (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP.).

Ethics committee opinion

A positive vote (1301/2020) of the Ethics Committee of the Johannes Kepler University Linz was obtained before the start of the study.



▶ **Fig. 1** Flow chart of included and excluded deliveries.

Results

Frequency of pregnancies in Austrian teenagers

During evaluation period 751 661 deliveries in Austria were recorded, of which 11 809 were girls under 20 years of age. 49 deliveries were reported for girls in early adolescence (10 to 14 years of age). This corresponds to a rate of 1.6 % teenage pregnancies during the observation period. Since none of the mothers was younger than 13 years of age, the terms teenagers and adolescents can be used synonymously in this cohort.

10 562 (89 %) of parturients under 20 years of age were primiparous.

The parameters collected from the register are summarized in ▶ **Table 1**, ▶ **Table 2**, ▶ **Table 3**, ▶ **Table 4**.

▶**Table 1** Maternal characteristics according to age category (IQR = Interquartile Range; BMI = Body Mass Index; SD = Standard Deviation).

	≤ 19 years (n = 10 562)	**19–39 years** (n = 361 940)	**P value**
Age (years) (mean, SD)	18.1 ± 1.1	29.3 ± 4.6	< 0.001
Weight (kg) (mean, SD)	60.8 ± 13.2	65.0 ± 13.6	< 0.001
Height (cm) (mean, SD)	164.0 ± 6.4	166.3 ± 6.2	< 0.001
BMI (kg/m^2) at the beginning of pregnancy (mean, SD)	22.5 ± 4.5	23.5 ± 4.6	< 0.001
Maternal obesity (n, %)	628 (6.9 %)	28 348 (9.1 %)	< 0.001
Gestational diabetes (n, %)	255 (2.4 %)	14 323 (4.0 %)	< 0.001
Smoking during pregnancy (n, %)	2321 (22.7 %)	20 551 (5.7 %)	< 0.001
Maternal mortality (n, %)	0 (0 %)	16 (0.00004 %)	0.494

▶**Table 2** Neonatal outcome according to age category (IQR = Interquartile Range; NICU = Neonatal Intensive Care Unit; SD = Standard Deviation).

	≤ 19 years (n = 10 562)	**19–39 years** (n = 361 940)	**P value**
Birthweight (g) (mean, SD)	3216 ± 564	3247 ± 576	< 0.001
Height (cm) (mean, SD)	49.98 ± 3.11	50.31 ± 3.16	< 0.001
Weight ≤ 3 rd percentile (n, %)	504 (4.8 %)	12 835 (3.6 %)	< 0.001
Weight ≥ 97 th percentile (n, %)	625 (6.0 %)	26 590 (7.4 %)	< 0.001
Arterial umbilical cord pH (mean, SD)	7.25 ± 0.08	7.26 ± 0.08	< 0.001
Venous umbilical cord pH (mean, SD)	7.31 ± 0.07	7.32 ± 0.08	< 0.001
Arterial cord pH < 7.0 (n, %)	38 (0.37 %)	1316 (0.38 %)	0.940
Apgar 1-minute (mean, SD)	8.72 ± 1.30	8.74 ± 1.23	0.017
Apgar 5-minute (mean, SD)	9.66 ± 1.06	9.67 ± 0.97	< 0.001
Apgar 10-minute (mean, SD)	9.83 ± 0.90	9.85 ± 0.81	0.265
5-minute Apgar < 4 (n, %)	79 (0.75 %)	1958 (0.54 %)	0.004
5-minute Apgar < 7 (n, %)	186 (1.77 %)	4937 (1.37 %)	0.001
Transfer to NICU (n, %)	852 (8.1 %)	28 364 (7.8 %)	0.386
Neonatal mortality (n, %)	75 (0.7 %)	2029 (0.6 %)	0.043

▶**Table 3** Delivery according to age category (IQR = Interquartile Range; SD = Standard Deviation; WoP = Week of Pregnancy).

	≤ 19 years (n = 10 562)	**19–39 years** (n = 361 940)	**P value**
WoP at delivery (mean, SD)	38.8 ± 2.2	38.8 ± 2.2	0.170
Induction of labor (n, %)	2445 (23.1 %)	82 674 (22.8 %)	0.459
Premature rupture of membranes (PROM) (n, %)	2518 (23.8 %)	105 119 (29.0 %)	< 0.001
Caesarean section rates (primary and secondary) (n, %)	1557 (21.1 %)	114 990 (31.8 %)	< 0.001
Operative vaginal birth (n, %)	923 (8.7 %)	42 196 (11.7 %)	< 0.001
Episiotomy (n, %)	1590 (15.1 %)	59 385 (16.4 %)	< 0.001
Perineal tear III or IV (n, %)	135 (1.3 %)	7677 (2.1 %)	< 0.001
Multiples (n, %)	149 (1.4 %)	12 044 (3.3 %)	< 0.001

▶**Table 4** Preterm birth rates and birth weight according to age category (SD = standard deviation).

	Preterm birth rates			Birth weight (g) per subgroup (mean, SD)		
	≤ 19 years (n, %)	19–39 years (n, %)	P value	≤ 19 years	19–39 years	P value
Total preterm births	913 (8.7 %)	32 873 (9.2 %)	0.111			
Border of viability	15 (0.14 %)	453 (0.13 %)	0.618	495 ± 118	565 ± 206	0.037
Extreme preterm birth	52 (0.5 %)	1641 (0.45 %)	0.537	859 ± 270	818 ± 225	0.382
Very preterm birth	104 (0.99 %)	3610 (1.0 %)	0.931	1369 ± 370	1388 ± 336	0.440
Moderate preterm birth	110 (1.05 %)	4464 (1.24 %)	0.085	1881 ± 329	1907 ± 350	0.677
Mild preterm birth	632 (6.02 %)	22 705 (6.29 %)	0.271	2586 ± 458	2527 ± 424	0.002

Maternal characteristics

The mothers in the age group ≤ 19 years were on average 18.1 ± 1.1 years old and the mothers in the group of 20 to 39 29.3 ± 4.6 years old (p < 0.001).

The mean body weight at the beginning of pregnancy was significantly lower in the under-20-year-old group (60.8 ± 13.2 vs. 65.0 ± 13.6 kg, p < 0.001). The teenage pregnant women had a lower body height (164.0 ± 6.4 vs. 166.3 ± 6.2 cm, p < 0.001) and a lower body mass index (BMI) at the beginning of pregnancy (22.5 ± 4.5 vs. 23.5 ± 4.6 kg/m^2, p < 0.001).

The rate of obesity (defined as BMI ≥ 30 kg/m^2) was 6.9 % in the teenage mother group and 9.1 % in the adult group (p < 0.001).

The number of women with gestational diabetes was also higher in the age category over 20 years than in young mothers (2.4 vs. 4.0 %, p < 0.001). Among teenagers were significantly more smokers (22.7 vs. 5.7 %, p < 0.001). No difference was found in peripartum maternal mortality (0 % vs. 0.00004 %, p = 0.494).

The maternal characteristics according to age groups are shown in ▶ **Table 1**.

Neonatal outcome

The neonates of pregnant women under 20 years of age had a lower birth weight (3216 ± 564 vs. 3247 ± 576 g, p < 0.001) and a shorter body length (49.98 ± 3.11 vs. 50.31 ± 3.16 cm, p < 0.001).

In addition, the newborns of teenage mothers were more often at or below the 3rd percentile concerning birthweight (4.8 vs. 3.6 %, p < 0.001). The birthweight of children from adult mothers was significantly more often equal or greater than the 97th percentile (6.0 vs. 7.4 %, p < 0.001).

The postpartum pH values in the umbilical cord artery were significantly lower in the newborns of mothers under 20 years of age than in those of adult mothers (7.25 ± 0.08 vs. 7.26 ± 0.08, p < 0.001). The venous umbilical cord pH values were also lower in teenage mothers (7.31 ± 0.07 vs. 7.32 ± 0.08, p < 0.001). Concerning the rate of severe fetal acidosis (arterial umbilical cord pH < 7.0), there was no significant difference between the two groups (0.37 vs. 0.38 %, p = 0.940).

The Apgar scores of neonates from young mothers were significantly lower after 1 and 5 minutes, the Apgar score after 10 minutes did not differ significantly (Apgar 1-minute 8.72 ± 1.30 vs. 8.74 ± 1.23, p = 0.017; Apgar 5-minute 9.66 ± 1.06 vs. 9.67 ± 0.97, p < 0.001; Apgar 10-minute 9.83 ± 0.90 vs. 9.85 ± 0.81, p = 0.265).

The newborns of teenage mothers had significantly higher rates of very low (< 4) and low (< 7) Apgar scores after 5 minutes (5-minute Apgar < 4: 0.75 vs. 0.54 %, p = 0.004) (5-minute Apgar < 7: 1.77 vs. 1.37 %, p = 0.001).

There was no difference in the frequency of transfers to the neonatal intensive care unit (NICU) (8.1 vs. 7.8 %, p = 0.386). However, neonatal mortality was significantly higher in the group of teenage mothers (0.7 vs. 0.6 %, p = 0.043).

Neonatal outcome data according to age groups are summarized in ▶ **Table 2**.

Delivery

There was no difference in the week of pregnancy (WoP) at delivery (38.8 ± 2.2 vs. 38.8 ± 2.2 WoP, p = 0.170). Induction of labor was equally frequent performed in both age groups (23.1 vs. 22.8 %, p = 0.459). Premature rupture of the membranes (PROM) occurred significantly more frequently in adult mothers (23.8 vs. 29.0 %, p < 0.001).

The rate of primary and secondary Caesarean sections (21.1 vs. 31.8 %, p < 0.001) and the percentage of operative vaginal births (8.7 % vs. 11.7 %, p < 0.001) was significantly lower in young mothers than in adult mothers. In teenagers, episiotomy was performed less frequently (15.1 % vs. 16.4 %, p < 0.001) and there were fewer higher-grade perineal tears (Grade III and IV perineal tears) (1.3 vs. 2.1 %, p < 0.001). Significantly more deliveries of multiples were recorded in adult pregnant women (p < 0.001). Among the teenagers, there were 146 twin births (1.38 %) and 3 deliveries of triplets (0.03 %). Among adult women, 11 681 twins (3.23 %), 347 triplets (0.1 %) and 16 quadruplets (0.004 %) were recorded.

Delivery outcome data according to age groups are highlighted in ▶ **Table 3**.

Preterm birth rates

The rate of preterm birth < 37 + 0 WoP was not significantly different in the group of teenage mothers compared to adult mothers (8.7 vs. 9.2 %, p = 0.111). Additionally, a subgroup analysis

regarding WoP at delivery was performed (see ▶**Table 4**). According to international standards preterm birth was classified into following categories: border of viability (22 + 0 – 23 + 6 WoP), extremely preterm (24 + 0 – 27 + 6 WoP), very early preterm (28 + 0 – 31 + 6 WoP), moderately preterm (32 + 0 – 33 + 6 WoP) and mildly preterm (34 + 0 – 36 + 6 WoP).

No significant difference between teenagers and adult mothers was found in the frequency of preterm births within individual subcategories.

In addition, birthweight was compared in relation to WoP at delivery with the aim to minimize the influence of gestational age at birth. The newborns of young mothers born at the border of viability or mildly preterm had significantly lower birthweights than neonates from mothers between 20 and 39 years of age (border of fetal viability: 495 ± 118 vs. 565 ± 206 g, p = 0.037; mild preterm birth: 2586 ± 458 vs. 2527 ± 424 g, p = 0.002). No significant difference was found in the other categories (extreme preterm birth: 859 ± 270 vs. 818 ± 225, p = 0.382; very early preterm birth: 1369 ± 370 vs. 1388 ± 336, p = 0.440; moderate preterm birth: 1881 ± 329 vs. 1907 ± 350, p = 0.677).

Discussion

Despite declining rates in recent years, teenage pregnancies are a considerable obstetrical issue in Western countries and thus also in Austria. However, currently there are no evidence-based recommendations and/or guidelines for obstetric care of this important patient group.

The available data show that adolescent pregnant women have a lower height and body weight and a lower body mass index than adult pregnant women. This is accompanied by a significantly lower incidence of gestational diabetes and maternal obesity in younger pregnant women.

The proportion of smokers among teenagers is over 22 % and more than three times higher than that of adult pregnant women. This high discrepancy in concerns of smoking status between both groups could also be a possible selection bias as asking for risk factors in pregnant adolescents is probably more detailed during anamnesis. A documented rate of 5.7 % smokers among adult pregnant women seems relatively low. According to the European Perinatal Health Report 2015, the rate of pregnant women with nicotine abuse in Europe was between 3.6 % in Norway and 16.3 % in France [5]. A total of 17.8 % of all Austrian women reported smoking cigarettes in 2019 [20].

The birthweight and body length of the newborns of teenage mothers are significantly lower. The birthweight of neonates from teenage mothers is significantly more often at or below the 3rd percentile, while the birthweight of newborns from adult mothers is more frequently equal or higher than the 97th percentile. The lower birthweights and percentiles among neonates of teenage mothers might be explained by the physical constitution in concerns of partly unfinished body growth of adolescents. In the literature, the increased nutrient requirement of growing mothers and thus a kind of competition for nutrients with the fetus is discussed as a possible pathogenesis [15, 18].

The relationship between fetal macrosomia and gestational diabetes is clearly demonstrated in studies and guidelines [21, 22]. In the present study collective the birthweigth of newborns from mothers with gestational diabetes also tends to be higher. The lower percentage of mothers with gestational diabetes in the teenager group might be another reason for lower birthweights. Another explanation could be the higher rate of nicotine abuse in the group of pregnant teenagers. The relationship between smoking during pregnancy and low birthweight is also known [5, 23, 24].

Remarkable are the differences in neonatal umbilical cord pH values and Apgar scores with significantly lower Apgar scores after 1 and 5 minutes in the teenager group and higher rates of low (< 7) and very low (< 4) Apgar scores after 5 minutes. Lower Apgar scores in adolescent mothers have also been found in other studies, but the cause for this association remains unclear [13]. In the literature, an association between the level of maternal education and low Apgar scores is discussed [25]. In addition, both low child weight and inadequate prenatal screening examinations are considered risk factors for low Apgar scores in adolescent mothers [26]. No difference in the rate of transfers to the NICU was found in the available data. However, neonatal mortality was significantly higher in mothers under 20 years of age than in adult mothers. These results are in line with international studies [15].

The high rate of above-mentioned obstetric complications compared to adult mothers might be explained by the fact that pregnant teenagers consult their health care provider for screening examinations less frequently or late during pregnancy [2, 12, 27]. Studies have shown that these prenatal examinations significantly improve pregnancy outcome, especially in adolescent mothers [16, 27]. Late sonographic examinations during pregnancy, especially after the 23rd WoP, can be misleading for calculation of the delivery due date. Pregnancies with an unclear due date are known to be associated with a worse obstetric outcome [28]. Variables such as performed screening examinations or ambiguity concerning due dates are not recorded in the GRÖ and thus represent a possible bias with regard to the poorer outcome in adolescent mothers.

In the present collective, no increased rate of preterm births could be found in teenage mothers, although according to the literature maternal age below 18 years was found to be a risk factor for preterm birth [17]. The analysis of the various classes of preterm births, ranging from border of viability to mild preterm births, also shows no significant difference between young and adult mothers.

However, it should be emphasized that in the present collective, the birthweight at the border of viability (22 + 0 – 23 + 6 WoP) in the cohort of teenage mothers was significantly lower than in the newborns of adult mothers (495 ± 118 vs. 565 ± 206 g, p = 0.037). In perinatal and neonatal counselling of mothers with threatened preterm birth in this critical phase of pregnancy estimated fetal weight is a fundamental parameter to calculate the probabilities for neonatal survival and morbidity, which significantly influences the decision to/or not to initiate provisional care. In addition to the WoP, various prognostic tools also implicate estimated fetal weight for risk calculation. One of these tools is the National Institutes of Health (NIH) Extremely Preterm Birth Outcomes Tool, which makes it possible to assess the perinatal outcome, in particular the average chance of survival and

the risk of neurological impairments [29]. For example, when calculating the average survival for a female fetus in the completed 23rd WoP after a full course of antenatal corticosteroids and with an estimated fetal weight of 495 g (average weight of newborns in the teenager group), the probability for survival would be 43 %. In a fetus under the same conditions and an estimated weight of 565 g (average weight of newborns in the adult mother group), the average survival would be 50 % and thus significantly higher [30].

Therefore, it is essential to consider possible differences in children's weight when counselling pregnant teenagers in that situation. If weight limits are drawn for all pregnant women regardless of maternal age, this will lead to incorrect judgements in counselling of adolescent mothers as constitutional weight differences are neglected. Furthermore, data from existing literature show that the expertise of the maternity clinic in concerns of preterm birth has a significant effect on the delivery outcome [29]. Due to the less frequent or late pregnancy screening examinations of teenage pregnant women [2, 12, 27], an immediate transfer of teenage mothers with threatened preterm birth to a perinatal center with high level expertise is mandatory.

Contrary to various international studies [2, 16], no increased occurrence of PROM in pregnant teenagers was found in this cohort. This might be explained by the fact that screening examinations for infections are part of the Austrian mother-child passport (Mutter-Kind-Pass) and thus vaginal infections as possible triggers for PROM might be recognized in earlier stages and, if necessary, adequately treated.

The caesarean section rate in the under-20 age group was significantly lower than for women over 20 years of age. In the younger age group, the rate of caesarean sections was about a third lower. The literature confirms a lower caesarean section rate in teenage mothers and an increasing rate of caesarean sections with a higher maternal age [2, 16, 31]. This might be due to the lower percentage of macrosomia and the rarer use of oxytocin during childbirth in adolescent mothers [32]. In older pregnant women, the contractility of the myometrium and the number of oxytocin receptors decrease, which is associated with a higher rate of caesarean sections [31, 33].

The significantly lower rate of operative vaginal births in the group of younger mothers (8.7 %) compared to adult mothers (11.7 %) overlaps with data from international studies [2]. In mothers under the age of 20, episiotomy was performed less frequently during delivery and the rate of higher-grade perineal tears was lower. This could possibly be related to the lower rate of operative vaginal births in teenage mothers, since in practice an episiotomy, especially in the presence of pathological CTGs, is frequently performed during vacuum extraction. Whether a routine episiotomy reduces the rate of higher-grade birth injuries during operative vaginal births is considered controversial and is not clearly evident from the literature [34]. Moreover, the newborns of teenage mothers were significantly lighter and smaller. This could also explain the lower rate of higher-grade perineal tears, episiotomies and operative vaginal births.

A strength of this study is the large number of cases, which results in statistical significances even in parameters with only small differences, such as neonatal pH values and Apgar scores. Limitations of this study are the retrospective design and incomplete/missing documentation of relevant pregnancy risks, such as hypertensive pregnancy disorders, number of abortions/terminations of pregnancy and timepoints of pregnancy screening examinations, within the GRÖ. In addition, the quality of data in register studies is dependent on numerous variables, such as the accuracy and completeness of data inputs. Furthermore, the influence of socioeconomic factors in teenage pregnancies cannot be verified due to the lack of documentation in the GRÖ, which can be considered a potential bias of the results.

Conclusion

The data of this study highlight that pregnancy and delivery in teenage mothers need to be considered differently than in adults. A lower birth weight in newborns of teenage mothers, as well as a significantly lower caesarean section rate, confirm the data from the existing literature. Prenatal and peripartum care of these young mothers needs to be optimized in order to reduce worse neonatal outcomes, such as lower Apgar scores/pH values and infant mortality, in the future. Particular causes for these worse outcomes in teenage mothers remain unclear and should be subject of future investigations.

Moreover, further studies are needed to shed more light on pregnancy risks, such as hypertensive pregnancy disorders or socioeconomic effects of pregnancies in Austrian teenagers. Furthermore, obstetricians should be supported by evidence-based recommendations and/or guidelines in regards of pregnancy care in teenage mothers.

Conflict of Interest

Patrick Stelzl works as a consultant and speaker and is a member of the steering committee for the LION ("Labour Induction Outcomes Network") project for Angusta 25 µg tablets from Norgine Pharma GmbH. The other authors declare that there are no conflicts of interest. / Patrick Stelzl hat eine werksvertraglich geregelte Tätigkeit als Berater und Referent und ist Mitglied des Steuerungskomitees im Rahmen des LION-(„Labour Induction Outcomes Network"-)Projekts für Angusta 25 µg Tabletten von Norgine Pharma GmbH. Die weiteren Autoren erklären, dass keine Interessenkonflikte bestehen.

References/Literatur

[1] Chandra-Mouli V, Camacho AV, Michaud PA. WHO Guidelines on Preventing Early Pregnancy and Poor Reproductive Outcomes Among Adolescents in Developing Countries. J Adolesc Health 2013; 52: 517–522. doi:10.1016/j.jadohealth.2013.03.002

[2] Fleming N, O'Driscoll T, Becker G et al. Adolescent Pregnancy Guidelines. J Obstet Gynaecol Can 2015; 37: 740–756. doi:10.1016/S1701-2163(15)30180-8

[3] WHO. Adolescent health. 2022 . Accessed April 05, 2022 at: https://www.who.int/health-topics/adolescent-health

[4] Sedgh G, Finer LB, Bankole A et al. Adolescent pregnancy, birth, and abortion rates across countries: levels and recent trends. J Adolesc Health Off Publ Soc Adolesc Med 2015; 56: 223–230. doi:10.1016/j.jadohealth.2014.09.007

[5] Euro-Peristat Project. European Perinatal Health Report. Core indicators of the health and care of pregnant women and babies in Europe in 2015. 2018 . Accessed September 16, 2022 at: https://www.europeristat.com/images/EPHR2015_web_hyperlinked_Euro-Peristat.pdf

[6] United Nations Department of Economic and Social Affairs. Demographic Yearbook 70th Issue – 2019. Accessed February 20, 2022 at: https://unstats.un.org/unsd/demographic-social/products/dyb/dyb_2019/

[7] Part K, Moreau C, Donati S et al. Teenage pregnancies in the European Union in the context of legislation and youth sexual and reproductive health services. Acta Obstet Gynecol Scand 2013; 92: 1395–1406. doi:10.1111/aogs.12253

[8] Statistik Austria. Lebendgeborene seit 2005 nach Altersgruppen der Mutter und Bundesland. 15.02.2022 . Accessed February 23, 2022 at: https://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/bevoelkerung/geborene/index.html

[9] Vargas G, Borus J, Charlton BM. Teenage pregnancy prevention: the role of young men. Curr Opin Pediatr 2017; 29: 393–398. doi:10.1097/MOP.0000000000000510

[10] Catic A. Teenagerschwangerschaften – ein weltweiter Überblick und die Situation in Österreich. J Gynäkol Endokrinol AT 2021; 31: 109–111. doi:10.1007/s41974-021-00197-5

[11] Gigante D, de França G, De Lucia Rolfe E et al. Adolescent parenthood associated with adverse socio-economic outcomes at age 30 years in women and men of the Pelotas, Brazil: 1982 Birth Cohort Study. BJOG 2019; 126: 360–367. doi:10.1111/1471-0528.15428

[12] Azevedo WF, Diniz MB, Fonseca ES et al. Complications in adolescent pregnancy: systematic review of the literature. Einstein (Sao Paulo) 2015; 13: 618–626. doi:10.1590/S1679-45082015RW3127

[13] Wong SPW, Twynstra J, Gilliland JA et al. Risk Factors and Birth Outcomes Associated with Teenage Pregnancy: A Canadian Sample. J Pediatr Adolesc Gynecol 2020; 33: 153–159. doi:10.1016/j.jpag.2019.10.006

[14] Pergialiotis V, Vlachos D-EG, Gkioka E et al. Teenage pregnancy antenatal and perinatal morbidity: Results from a tertiary centre in Greece. J Obstet Gynaecol 2015; 35: 595–599. doi:10.3109/01443615.2014.991285

[15] Chen XK, Wen SW, Fleming N et al. Teenage pregnancy and adverse birth outcomes: a large population based retrospective cohort study. Int J Epidemiol 2007; 36: 368–373. doi:10.1093/ije/dyl284

[16] Marino J, Lewis L, Hickey M et al. Teenage mothers. Aust J Gen Pract 2016; 45: 712–717

[17] Berger R, Abele H, Bahlmann F et al. Prevention and Therapy of Preterm Birth. Guideline of the DGGG, OEGGG and SGGG (S2k Level, AWMF Registry Number 015/025, February 2019) – Part 1 with Recommendations on the Epidemiology, Etiology, Prediction, Primary and Secondary Prevention of Preterm Birth. Geburtshilfe Frauenheilkd 2019; 79: 800–812. doi:10.1055/a-0903-2671

[18] Usta IM, Zoorob D, Abu-Musa A et al. Obstetric outcome of teenage pregnancies compared with adult pregnancies. Acta Obstet Gynecol Scand 2008; 87: 178–183. doi:10.1080/00016340701803282

[19] Geburtenregister Österreich (GRÖ). Datensicherheit und Datenschutz. 2022 . Accessed May 18, 2022 at: https://www.iet.at/page.cfm?vpath=register/geburtenregister#Datensicherheit/Datenschutz

[20] Statistik Austria. Aktueller Raucherstatus 2019. 09.12.2020 . Accessed March 13, 2022 at: https://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/gesundheit/gesundheitsdeterminanten/rauchen/index.html

[21] Kc K, Shakya S, Zhang H. Gestational Diabetes Mellitus and Macrosomia: A Literature Review. Ann Nutr Metab 2015; 66 (Suppl 2): 14–20. doi:10.1159/000371628

[22] Schäfer-Graf UM, Gembruch U, Kainer F et al. Gestational Diabetes Mellitus (GDM) - Diagnosis, Treatment and Follow-Up. Guideline of the DDG and DGGG (S3 Level, AWMF Registry Number 057/008, February 2018). Geburtshilfe Frauenheilkd 2018; 78: 1219–1231. doi:10.1055/a-0659-2596

[23] Jackson MA, Brown AL, Baker AL et al. The Incentives to Quit tobacco in Pregnancy (IQuiP) protocol: piloting a financial incentive-based smoking treatment for women attending substance use in pregnancy antenatal services. BMJ Open 2019; 9: e032330. doi:10.1136/bmjopen-2019-032330

[24] Peterson LA, Hecht SS. Tobacco, e-cigarettes, and child health. Curr Opin Pediatr 2017; 29: 225–230. doi:10.1097/MOP.0000000000000456

[25] Almeida NKO, Pedreira CE, Almeida RMVR. Impact of maternal education level on risk of low Apgar score. Public Health 2016; 140: 244–249. doi:10.1016/j.puhe.2016.04.009

[26] Karataşlı V, Kanmaz AG, İnan AH et al. Maternal and neonatal outcomes of adolescent pregnancy. J Gynecol Obstet Hum Reprod 2019; 48: 347–350. doi:10.1016/j.jogoh.2019.02.011

[27] Wong Shee A, Frawley N, Robertson C et al. Accessing and engaging with antenatal care: an interview study of teenage women. BMC Pregnancy Childbirth 2021; 21: 693–693. doi:10.1186/s12884-021-04137-1

[28] Anonymous. Committee Opinion No 700: Methods for Estimating the Due Date. Obstet Gynecol 2017; 129: e150–e154. doi:10.1097/AOG.0000000000002046

[29] Rysavy MA, Horbar JD, Bell EF et al. Assessment of an Updated Neonatal Research Network Extremely Preterm Birth Outcome Model in the Vermont Oxford Network. JAMA Pediatr 2020; 174: e196294. doi:10.1001/jamapediatrics.2019.6294

[30] National Institutes of Health (NIH). Extremely Preterm Birth Outcomes Tool. 03.02.2020 . Accessed May 20, 2022 at: https://www.nichd.nih.gov/research/supported/EPBO

[31] Schildberger B, Linzner D, Hehenberger L et al. Influence of Maternal Age on Selected Obstetric Parameters. Geburtshilfe Frauenheilkd 2019; 79: 1208–1215. doi:10.1055/a-0859-0826

[32] Katz Eriksen JL, Melamed A, Clapp MA et al. Cesarean Delivery in Adolescents. J Pediatr Adolesc Gynecol 2016; 29: 443–447. doi:10.1016/j.jpag.2016.01.123

[33] Kahveci B, Melekoglu R, Evruke IC et al. The effect of advanced maternal age on perinatal outcomes in nulliparous singleton pregnancies. BMC Pregnancy Childbirth 2018; 18: 343–343. doi:10.1186/s12884-018-1984-x

[34] Jiang H, Qian X, Carroli G et al. Selective versus routine use of episiotomy for vaginal birth. Cochrane Database Syst Rev 2017(2): CD000081. doi:10.1002/14651858.CD000081.pub3