The Perinatal Outcomes of High Risk Teenage Pregnancies at Tygerberg Hospital
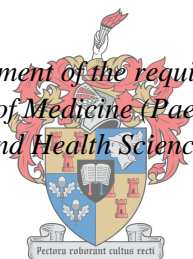
Thesis presented in fulfilment of the requirements for the degree of
Master of Medicine (Paediatrics)
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Declaration

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the author thereof (unless to the extent explicitly otherwise stated) and that I have not previously, in its entirety or in part, submitted it for obtaining any qualification.

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Signature: Dr Samantha Fry   Date

Abstract

Teenage pregnancy is associated with an increased risk in adverse maternal and neonatal outcomes. With an increase in the incidence of teenage pregnancy in South Africa, the aim of this study is to describe the perinatal outcomes of newborns, born to teenage women, requiring admission at a central hospital in the Western Cape.

Results: Teenage pregnancy accounted for 8% of the total deliveries at Tygerberg Hospital during a 6-month study period and 34% of these newborns were admitted for in-patient health care. Low birth weight and prematurity was commonly found in the teenage mother group with an incidence of 83% and 82% respectively. The two major reasons for newborn admission to the acute care ward were respiratory and neurological conditions, respectively 44% and 14%, while 5 newborns were admitted to the neonatal intensive care unit. A third of the newborns admitted, were discharged to their teenage mothers during or by the end of the perinatal period. Early neonatal death occurred in 2% of babies born to teenage mothers.

Conclusion: Of note was the high incidence of prematurity in infants born to teenage mothers, with more than a third admitted for respiratory conditions. This study indicates the need for further investigation into an association between teenage pregnancies and increased neonatal morbidity.

Introduction

Teenage pregnancy, also referred to as adolescent pregnancy, is defined as a pregnancy occurring in a female between the ages of 10-19 years at the time of delivery (1). This is often classified into the younger and older teenage groups, as there may be risks and adverse events. According to the World Health Organisation, globally, approximately 16 million girls between the ages of 15-19 give birth annually, which equates to about 11% of the total global deliveries (2). In 2014, the global estimated average birth rate in 15-19 year olds was 49 births per 1000 girls. The country with the lowest rate reported one birth per 1000 girls while the highest reported 299 births per 1000 girls. In the younger teenage category, approximately 1 million girls under 15 years of age give birth annually (2).

Despite this, the global trend over the last 50 years has seen a general decline in the rate of teenage pregnancy, with the highest incidence occurring in low income countries, in particular, Sub-Saharan Africa region (3,4). In South Africa, the 2015 General Household Survey revealed that during 2014/2015 5.3% of girls between the ages of 14-19 years were pregnant, an increase from the reported 4.9% in the 2012 survey (5,6). Similar to the global trend, the incidence increased with an increase in age and in the 14, 17 and 19 year olds, the incidence was respectively 0.6%, 6.2% and 9.7% (5). The South African rate of teenage pregnancy was 44 births per 1000 girls (aged 15-19

years), which is comparable to the global rate of 49 births per 1000 girls (3). In the Western Cape, 12.6%, 11.7% and 10.7% of all deliveries occurred in girls aged 15-19 years in 2013, 2014, and 2015 respectively, similar to the global average (7).

Factors contributing to teenage pregnancy are complex and involve both internal and external influences. The adolescent female not only undergoes a period of rapid physical growth and development, but also a multifaceted array of psychological, emotional, social and neurodevelopmental maturation.(8) Physiologically, reproductive maturation and puberty is a vital determinant of teenage pregnancy. Menarche marks the onset of a woman's reproductive ability with the initiation of a monthly cycle, controlled and influenced by a complex hormonal system. Multiple studies have shown that over the last century, there is a downward trend in the age at which girls reach menarche (9–11). In the US, a report from the National Health and Nutrition Examination Survey (1999-2004) (NHANES) showed an average decline in age of menarche of 0.9 years (0.7 to 1.4 years) between those born before 1920 and those born between 1980 and 1984 (11). It is well known that nutrition, socioeconomic status and race/ethnicity are all associated with earlier menarche (9,12). A similar analysis of the NHANES comparing women in the 1988-1994 survey to those in the 1999-2002 survey found that those, who reached menarche at an earlier age, were reported to have a higher BMI, and this was no different between the two time periods studied (13). In a South African urban population, although the age of menarche was found to be similar between Black and White women at the time of the study, the rate of decline in age was significantly higher in Blacks between 1956 and 2004 with an average of 0.5 years and 0.22 years respectively (14).

Early sexual debut is an important factor that affects teenage pregnancy with the average reported age of sexual debut in South Africa to be 16-18 years of age (15,16). Despite worldwide recognition of child marriage as a human rights violation, with a long lasting negative impact on girls' bio-psycho-social growth and development, there are still many countries in which this practice is a cultural and societal norm. In 2009, girls younger than 18 years of age accounted for 60 million of these marriages occurring world-wide, with the majority of these occurring in South Asia (17). In South Africa, statistics SA reported that 150 males and 1405 females under the age of 20 entered into a marriage, either customary or civil, in 2015 (18). While this certainly contributes to the prevalence of teenage pregnancy, it is not always the case that the marriage occurs prior to the pregnancy and as such, sexual debut often occurs premaritally (17).

 Another key determinant factor of teenage pregnancy is access to reproductive and family planning health care. In a South African study conducted amongst adolescent girls, there was a high rate of dissatisfaction regarding the availability of adolescent friendly reproductive and emergency contraception services (20). Lack of 24-hour services and the provision of holistic health information in a single consultation were highlighted as important problems. Despite this, the majority of the girls reported satisfaction at the general provision of appropriate health information at clinics via posters,

pamphlets and other printed materials (19). Of note, it was found, among antenatal and family planning healthcare workers in clinics in Soweto, that there is generally a negative viewpoint on adolescent female sexual activity (20). This opinion was shared both directly and indirectly. Another common opinion amongst the healthcare workers was that young women did not use the health information they received to prevent teenage pregnancy and sexually transmitted infections, including HIV (20).

Teenage pregnancy is associated with adverse maternal and neonatal outcomes .(22 - 24). Research in developing countries have shown that teenage pregnancy had an increased rate of eclampsia, preeclampsia and systemic infections (22,23) Another adverse maternal outcome noted to be higher in the teenage pregnancy population was anaemia (24,25).

The case for an association between younger maternal age and mode of delivery or assisted delivery is conflicting. In a study conducted in Cameroon, younger maternal age was observed to have more Caesarean section deliveries and fewer assisted deliveries, however, these were not found to be significant (p=0.295 and p=0.224 respectively) (22). Other studies have observed a lower rate of Caesarean section and assisted deliveries in the maternal teenage population (21,24–26) while one study reported a significantly higher rate in the younger (≤15 years) teenage group only (p=0.004) (23). In evaluating only teenage pregnancies, Caesarean section in both first and second deliveries was less commonly found. (27).

There is conflicting evidence regarding stillbirth and early neonatal death rate in teenage pregnancies in the literature. Studies have demonstrated both an increased rate of stillbirths and early neonatal mortality within teenage pregnancies (28,29) versus no significant difference between the teenage and non-teenage groups (22,26). The risk of stillbirth was found to be higher in teenagers experiencing their second birth as opposed to teenagers undergoing their first birth (27).

The Apgar score is a 5—point category clinical evaluation, used for more than 5 decades to assess the perinatal condition of the newborn at respectively 1 and 5 minutes of life. In particular, the 5-minute Apgar score is a strong indicator of risk for neonatal and infant death. (30) In one study, babies born to teenage mothers showed an increased risk for low and very low 5-minute Apgar scores i.e. <7 and <4 respectively (31).

 Despite these conflicting results, there is overwhelming evidence that teenage pregnancies are associated with an increased risk in premature delivery and low birth weight babies (22,27,29). One author suggested the increase in neonatal and postnatal death among the maternal teenage population is due to the increase incidence of prematurity and low birth weight, (32). Chen XK *et al* reported that, when these confounding factors were adjusted for, there was no significant association found between the teenage maternal age group and an increase in neonatal mortality (31).

Prenatal care is vital in the management of the pregnant woman and in identifying those at high risk of premature delivery, as well as to observe the growth and health of the fetus throughout the pregnancy. Although there is an established relationship between teenage pregnancy and these adverse obstetric and neonatal outcomes, it is suggested that the increase in risk is negated by adequate antenatal care (33).

The last decade has seen an increase in research and studies conducted addressing the factors related to and the outcomes of teenage pregnancy. As a result, there is growing evidence as to the association of maternal age on both the maternal and the neonatal outcomes. However, there is still conflicting evidence as to the impact of maternal age on these outcomes. Despite the global growing interest, there is paucity of South African teenage pregnancy data. While some qualitative research has been conducted, to the authors' knowledge, little to no quantitative data has been published within the South African context.

Research Question

To describe the perinatal outcomes of high risk teenage pregnancies at central hospital in the Western Cape.

Primary objectives

1. To determine the number of teenage deliveries at TBH compared to non-teenage deliveries.
2. To compare the rates of admission of babies born to teenage vs non-teenage women
3. To describe the outcome of teenage pregnancy neonatal admissions at the end of the perinatal period

Secondary Objectives

1. To determine and compare the incidence of stillbirths attributed to teenage and non-teenage deliveries.
2. To describe the reasons for admission and medical interventions of babies born to teenage mothers with high risk pregnancies
3. To describe the maternal and intrapartum factors that contribute to the reasons for admission of babies born to teenage women.

Methods

Site

This study was conducted at Tygerberg Academic Hospital situated (TBH), a central hospital in Cape Town, South Africa and serves as a referral hospital for approximately half of the Cape Town Metro, as well as 2 peri-urban and rural health regions of the Western Cape. The study was conducted in the neonatal wards of the Department of Paediatric and Child Health. High risk neonates born in the obstetric ward are referred to either the neonatal high-care wards or the neonatal intensive care unit (NICU). Annually the high-care neonatal wards admits 2100 neonates (Annual Report Tygerberg Hospital 2016)

Study design

This is a retrospective, descriptive study, done over a 6-month period (January to March as summer months and June to August as winter months in 2015). These months were chosen to assess the presence or absence of a seasonal variation in admissions of high risk deliveries.

Population studied: All deliveries occurring within the study period were included and the delivery outcomes described in the study. All newborn admissions born at TBH to women, who were 19 years or younger at the time of delivery were included in the study, with the primary endpoint the placement of the neonate on day 7 of life. The teenage mothers were categorised into those <18 years of age and those 18-19 years of age to identify potential differences between the younger and older teenager mothers. This is in keeping with what was found in the literature, and due to the sample size.

Inclusion criteria

All mother-and-child pairs of teenage deliveries that required admission at Tygerberg Hospital, that occurred during the study period, including live births and stillbirths were included.

Exclusion criteria

Newborns transferred in to TBH were excluded, as well as those born to women 20 years or older at the time of delivery.

Data management:

The TBH electronic birth records were obtained from the TBH Obstetrics Department and used to determine the total number of deliveries (both live births and stillbirths) at TBH within the study period.

The Perinatal Problem Identification Program (PPIP) data was accessed to extract maternal age and birth weight stratification data for the deliveries, as well as rates of different delivery modes. Using this data, the perinatal mortality rates was determined for both teenage and non-teenage deliveries. In multiple gestation, each baby was captured as a separate delivery.

The total number of acute admissions and those attributed to teenage pregnancies that occurred during the study period was determined using the ward admissions register and using this information, the maternal and newborn clinical records for each teenage delivery newborn admission was sourced from the TBH specific enterprise content management system (ECM).The ECM is an electronic database that houses the records of all Tygerberg Hospital patients including visits, management and treatment history. These records included ante- peri- and post- natal care and management for both the mother and the neonate.

The data obtained from ECM included:

- Age, gravidity and parity of the mother

- Antenatal data including: antenatal clinic attendance (booking), HIV and syphilis test results

- Obstetric data including: antenatal and obstetric complications as well as mode of delivery

- The condition of the newborn at delivery using the APGAR score as well as the need for and type of resuscitation required

- The weight and gestational age of the newborn

- The presence of intrauterine growth restriction

- Details regarding the admission of the neonate: reasons, diagnosis, medical management and intervention

Definitions:

Definition of terms used during data collection:

- Teenage pregnancy: a pregnant female younger than 20 years old at the time of delivery

- Non-teenage pregnancy: a pregnant female 20 year or older at the time of delivery

- Perinatal: the period within the first 7 days of life of a newborn

- Stillbirth: a fetal death after 20 completed weeks' gestation

- Early neonatal death: a death that occurs within the first week of life

- Late neonatal death: is a death that occurs between days 7-28 of life

- Perinatal deaths: the total number of stillbirths and early neonatal deaths

- Apgar score: is a clinical test completed at 1 and 5 minutes post-delivery and assess breathing effort, heart rate, muscle tone, reflex response and skin colour. The 1-minute score

is an indication of the newborn's tolerance of the birthing process and the 5-minute score is the response to extra-uterine life. Each parameter is graded 0-2 with zero being no response and 2 being the best response. The maximum score is 10.

- HIE: hypoxic ischaemic encephalopathy

- Prematurity (pre-term): is a neonate born before 37 weeks gestation (post-menstrual age)

- Term: is a neonate born after 36 completed weeks gestation

- Post term delivery: is a neonate born after 42 weeks completed gestation

This data was captured manually on a data collection sheet, transferred into an electronic dataset and analysed using GraphPad Prism 7.04 and Excel. All identifiers were removed, and each study case was allocated a unique study number in the electronic database. The data was backed up regularly and stored in a secure cabinet and on a password protected computer. Only the researcher and supervisors had access to the data. All data was gathered and stored according to the Helsinki Declaration with paper-based data collection which included identifying data to be stored and archived at completion of the study..

The descriptive analysis reports include demographic data as well as means and proportions. Comparisons were made between teenage and non-teenage deliveries. Within the teenage delivery group, those admitted were stratified into older and younger teenage age groups. Analyses were done with SPSS statistics version 25 (IMB Corporation, South Africa). Chi-square p-values are presented for comparison between groups, Fisher's exact p-value is presented for expected cell size less than five. Mann-Whitney U test p-value is presented for comparison of medians. Statistical significance was set at p=0.05.

Ethics:

The Stellenbosch University Health Research Ethics Committee provided ethical approval with a waiver of individual consent for the included participants. The custodian of the data provided consent to access the databases. (HREC reference # S14/09/199).

Standard Operating Procedure for Preterm deliveries at Tygerberg Hospital

The policy of Tygerberg Hospital is that all deliveries occurring prior to 35 weeks' gestation and under 1800g require admission, particularly if the cause for the prematurity is unknown. In those cases, the newborn is admitted and managed as a septic risk; septic markers are investigated, antibiotics are administered for a minimum of 48 hours and discontinued if the results are negative – including no growth on the blood culture.

Barring any other clinical reason for admission, those who are classified as a late premature neonate (born between 35 and 36 completed weeks) and weighing >1800g, who would be eligible for discharge to their mother after 48 hours.

Results

There were 7481 deliveries at Tygerberg Hospital in 2015, with 54% of those being vaginal deliveries and 46% attributed to Caesarean section. During the six-month study period, 4002 deliveries yielded 3744 live births (93.6%) and 258 stillbirths (6.4%). Teenage deliveries constituted 336 cases (8.4%) of whom 308 (91.6%) resulted in live births. No seasonal variation was observed in this study. See table 1.

Table 1

Age	Total n (%)	alive	Stillborn
<18	139 (3.5)	124 (89.2)	14 (10.8)
18-19	197 (4.9)	184 (93.4)	13 (6.6)
>=20	3666 (91.6)	3435 (93.7)	231 (6.3)
Total	4002 (100.0)	3744 (93.6)	258 (6.4)

Table 1: The total deliveries, live births and stillbirths rates for teenage and non-teenage mothers during the study period.

The Caesarean section rate was lower in teenage mothers than non-teenage mothers (< 18 years 32.4%, 18-19 years 34.1%, ≥ 20 years 47.2%). See table 2.

Table 2

Age	Total n (%)	Caesarean	Vaginal	Vaginal breach	Vacuum	Forceps
<18	139 (3.5)	45 (32.4)	83 (59.7)	5 (3.6)	6 (4.3)	0 (0.0)
18-19	197 (4.9)	67 (34.1)	123 (62.9)	3 (1.5)	3 (1.5)	0 (0.0)
>=20	3666 (91.6)	1729 (47.2)	1817 (49.6)	62 (1.7)	46 (1.3)	5 (0.1)
Total	4002 (100.0)	1841 (46.0)	2023 (50.6)	70 (1.8)	55 (1.4)	5 (0.1)

Table 2: modes of delivery and use of assisted delivery for teenage and non-teenage deliveries.

Teenage deliveries that resulted in neonatal admission

A total of 102 teenage mothers (age 14-19 years, mean 17.7 years) participated in this study. The 102 deliveries produced 104 babies with 3 twin deliveries, one set requiring admission for only 1 twin (the other twin therefore not included in the analysis). One of the babies were admitted directly to the (NICU). When stratified for age, 35 of the teenage admissions (33.7%) were to mothers under 18 years of age and 69 (66.3%) to mothers in the 18-19 year old age group. The youngest mother in the group requiring admission was 14 years old, while the youngest mother to deliver was 13 years of age. Of studied group, 57 male (55%) and 47 female (45%) neonates were admitted. The total neonatal acute care ward admissions for the study period was 1080, of which 9.5% were due to teenage pregnancies (n=104). This equates to nearly one third of all teenage deliveries. See table 3.

Table 3

	Total	<18 years n (%)	18-19 years n (%)	>20 years n (%)
admissions	1080 (27%)	35 (25.2%)	69 (35%)	976 (26.6%)

Table 3: The rate of admission to the acute care ward expressed as a percentage of live births in each of the age groups.

The majority teenage mothers were booked prior to delivery (n=96; 94.1%). This was the first pregnancy for most of the mothers (n=88, 86.3%) with a higher rate of second pregnancies in the older teenage group: 11 women were carrying their second pregnancy versus 1 in the younger group Five mothers were HIV positive (4.9%) with 4 mothers having concomitant HIV infection and syphilis. No infant had HIV infection, as determined with PCR. Of the 4 newborns that were exposed to syphilis in utero, 1 tested positive and was treated for congenital syphilis. spontaneous preterm labour (SPTL) (n=30, 29.4%) and preeclampsia (PET) (20, 19.6%) were the most common antenatal diagnoses. Half of the teenage deliveries, where the newborn required admission were vaginal deliveries, with a small number of those being assisted (n=5 5.0%). There were 50 Caesarean sections, of which one required the use of an assisted device . See table 4.

Table 4

	Total n(%)	<18 (n=35) n(%)	18-19 (n=69) n(%)	p-value
HIV positive	5 (4.9)	2 (5.9)	3 (4.4)	1.000±
VDRL positive	4 (4.0)	2 (5.9)	2 (3.0)	0.601±
Booked	96 (94.1)	32 (94.1)	64 (94.1)	-
Primigravida	88 (86.3)	32 (94.1)	56 (82.4)	0.713±
Gravida 2	12 (11.8)	1 (2.9)	11 (16.2)	0.097±
Gravida 3	2 (2.0)	1 (2.9)	1 (1.5)	1.000±
Vaginal delivery	45 (45.0)	12 (35.4)	33 (50.0)	-
Assisted delivery	5 (5.0)	3 (8.8)	2 (3.0)	0.152
Caesarean section	50 (50.0)	19 (55.9)	31 (47.0)	0.239
SPTL	30 (29.4)	8 (23.5)	22 (32.4)	0.357
PET	20 (19.6)	4 (11.8)	16 (23.5)	0.158
HELLP	2 (2.0)	0 (0.0)	2 (2.9)	0.551±

Table 4: The maternal antenatal data and mode of delivery of each age group expressed as a percentage of the mothers in each group, SPTL=Spontaneous Preterm Labour PET= preeclampsia; HELLP=Hypertension, Elevated Liver enzymes and Low platelets; HELLP=Hypertension, Elevated Liver enzymes and Low platelets ± Fisher's Exact p-value data not available for 2 mothers.

Newborns of teenage mothers admitted for acute care

Most children were born at gestational age <35 weeks (n=80, 78.4%) and almost half of the children had a birth weight of 1500-2.499 grams (n=49, 48.0%). Mean APGAR score at 1 minute was 7.2 (median 8), which improved and was 8.6 (median 9) at 5 minutes. Resuscitation was required for 69 children (69%) (mask continuous positive airway pressure n=60, mask intermittent positive airway pressure n=28, endotracheal intubation n=6, chest compressions n=5, adrenaline n=1). During the perinatal period, 56 children (55.4%) received an intervention (continuous positive airway pressure n=51, nasal prong oxygen n=32, intermittent positive airway pressure n=5, high frequency oscillation ventilation n=1).see table 5.

Table 5

		Total n(%)	<18years (n=34)	18-19years (n=68)	p-value
Gestational age	<35 weeks	80 (78.4)	24 (70,6%)	56 (82,4%)	-
	35-36^{+6} weeks	4 (3.9)	2 (5,9%)	2 (2,9%)	0.584±
	≥37 weeks	18 (17.6)	8 (23,5%)	10 (14,7%)	0.238
Birth weight	<1000g	13 (12.7)	3 (8.8)	10 (14.7)	
	1000g – 1499g	23 (22.5)	9 (26.5)	14 (20.6)	0.468±
	1500g – 2499g	49 (48.0)	17 (50.0)	32 (47.1)	0.520±
	≥2500g	17 (16.7)	5 (14.7)	12 (17.6)	1.000±
IUGR		11 (10.8)	4 (11.8)	7 (10.3)	1.000±

Table 5: Demographic data of babies requiring admission to neonatal service, stratified according age of mother IUGR= IntraUterine Growth Restriction ± Fishers Exact p-value, § Mann-Whitney U test p-value, data not available for 2 babies

Newborn health outcomes

The majority of newborns had jaundice (n=63, 62.4%). Septic risk (n=40, 39.6%), spontaneous preterm labour (n=34, 33.7%) and hyaline membrane disease (n=23, 22.8%) were prevalent diagnosis in new-borns. Children who were born from mothers <18 years were more likely diagnosed with sepsis (5 of 34, 14.7%) compared to children born from mothers ≥18 years (2 of 67, 3.0%) (p=0.041±). A detailed description of the diagnosis's and outcomes are presented in table 6.

Table 6

	Total	<18 years	≥18 years	χ^2
N=101	N (%)	N (%)	N (%)	p-value
Neonatal jaundice	63 (62.4)	23 (67.6)	40 (59.7)	0.436
Septic risk	40 (39.6)	12 (35.3)	28 (41.8)	0.528
Hyaline membrane disease (HMD)	23 (22.8)	8 (23.5)	15 (22.4)	0.897
Transient Tachypnea (TTN)	9 (8.9)	2 (5.9)	7 (10.4)	0.447
Electrolyte disturbances	8 (7.9)	3 (8.8)	5 (7.5)	1.000±
Sepsis	7 (6.9)	5 (14.7)	2 (3.0)	0.041±*

Hypoxic ischemic encephalopathy (HIE)	6 (5.9)	3 (8.8)	3 (4.5)	0.402±
Hypoglycaemia	5 (5.0)	3 (8.8)	2 (3.0)	0.332±
GMH & IVH	5 (5.0)	1 (2.9)	4 (6.0)	0.661±
Apnoea	4 (4.0)	1 (2.9)	3 (4.5)	1.000±
Anaemia	4 (4.0)	3 (8.8)	1 (1.5)	0.110±
Congenital pneumonia	3 (3.0)	2 (5.9)	1 (1.5)	0.261±
Chorioamnionitis	3 (3.0)	0 (0.0)	3 (4.5)	0.549±
Neutropaenia	3 (3.0)	0 (0.0)	3 (4.5)	0.549±
Hyperglycaemia	2 (2.0)	0 (0.0)	2 (3.0)	0.549±
Cephalohaematoma	2 (2.0)	1 (2.9)	1 (1.5)	1.000±
Exchange transfusion (ET)	2 (2.0)	1 (2.9)	1 (1.5)	1.000±
Patent ductus arteriosus (PDA)	2 (2.0)	0 (0.0)	2 (3.0)	0.549±
APGAR <7	2 (2.0)	1 (2.9)	1 (1.5)	1.000±
Seizures	2 (2.0)	0 (0.0)	2 (3.0)	0.549±
Thrombocytopaenia	2 (2.0)	1 (2.9)	1 (1.5)	1.000±
Healthcare associated infections (HAI)	2 (2.0)	0 (0.0)	2 (3.0)	0.549±
Spontaneous intestinal perforation (SIP)	1 (1.0)	0 (0.0)	1 (1.5)	1.000±
Renal impairment	1 (1.0)	0 (0.0)	1 (1.5)	1.000±
Leucopenia	1 (1.0)	1 (2.9)	0 (0.0)	0.337±
Haemoptysis	1 (1.0)	1 (2.9)	0 (0.0)	0.337±
Syphilis	1 (1.0)	0 (0.0)	1 (1.5)	1.000±
Cooled	1 (1.0)	0 (0.0)	1 (1.5)	1.000±
Hypoxic brain injury	1 (1.0)	0 (0.0)	1 (1.5)	1.000±

Table 6: newborn diagnosis as per age category of mother. GMH & IVH=Germinal Matrix Haemorrhage & IntraVentricular Haemorrhage, * p-value <0.05

Clinical outcomes relating to gestational age and birth weight

Neonatal jaundice was diagnosed in 72.2% of babies born prematurely and 80.6% in the lower birth weight category. HMD was more frequently seen in the premature and low birth weight groups: 29.1% and 50% respectively, while TTN was diagnosed in 31.8% of babies born ≥35 weeks and 13.8% of those born ≥1500g. see tables 7 and 8.

Table 7

	<35 weeks	≥ 35 weeks	P value
Neonatal jaundice	72.2%	27.3%	<0.001
SPTL	41.8%	4.5%	0.001
HMD	29.1%	0	0.004
TTN	2.5%	31.8%	<0.001

Table 7: clinical outcomes related to gestational age. SPTL= spontaneous preterm labour, HMD=hyaline membrane disease, TTN=transient tachypnoea of the newborn

Table 8

	<1500g	≥ 1500g	P value
Neonatal jaundice	80.6%	52.3%	<0.005
HMD	50.0%	7.7%	<0.001
TTN	0	13.8%	<0.025
Electrolyte disturbances*	16.7%	7.9%	0.023

Table 8: clinical outcomes related to birth weight. HMD=hyaline membrane disease, TTN=transient tachypnoea of the newborn.

*electrolyte disturbances include increased and decreased sodium and potassium

Outcome at the end of the perinatal period

Thirty-one children (30.7%) were discharged to their mother and 70 children remained in hospital (35 transferred to lower level ward at Tygerberg hospital, 23 stayed in acute ward at Tygerberg hospital, 6 transferred to lower level facility, 4 were transferred to NICU and 2 babies died).

Table 9

Day 7 outcome	Total	<18 years = 34	18-19 years = 67
Stayed in service	63 (62.4%)	19 (56%)	44 (66%)
High -Care	23	8 (24%)	15 (22%)
General care	36	11 (32%)	25 (37%)
Intensive Care	5	1 (3%)	4 (6%)
Discharged to mother	31 (30.7%)	14 (41.2%)	17 (25.4%)
Transferred outside	5 (5%)	0	5 (7.5%)
Died	2 (2%)	1 (3%)	1 (1.5%)

Table 9: The day 7 outcome of teenage mother live deliveries requiring admission

During the period studied, 8% of all teenage deliveries ended with the newborn requiring admission for acute care, which amounted to 9.5% of the total admissions. The majority of deliveries to teenage mothers were live births (91.7%). Preeclampsia was more prevalent in mothers whose newborns were admitted. While not statistically significant, prematurity was more prominent in the older teenage group. The most common neonatal diagnoses were neonatal jaundice (62.4%), respiratory distress syndrome (43.6%) and those with a septic risk (39.6%). At the end of the neonatal period, almost two thirds of the admitted newborns were still in clinical care at the admitting hospital, with 5% down referred to lower level care facilities and 2% had died.

Discussion

The prevalence of teenage pregnancies varies in LMICs from 29 per 1000 deliveries in India to 154 per 1000 deliveries in Uganda.(23) This study reported a prevalence of 8%, similar to the Thailand study (22,23,25). Of the total teenage deliveries, 8% were stillbirths, and 31% of the live births required admission into an acute care ward, as compared to 6.3% and 26.6% found in the older maternal age category (≥ 20 years) respectively. An increased incidence in stillbirths in teenage deliveries has been previously found when comparing adverse maternal and newborn outcomes between teenage and non-teenage deliveries. (28). In India, a significant difference in the stillbirth rate between teenage and non-teenage mothers: 5.1% and 0.9% respectively, was found. (28) In this study, while the rate in the teenage pregnancy population was higher (8%) this was not significant when compared to the non-teenage group (6.3%)

In the Western Cape Province in 2015, 10 006 babies were born to mothers aged 19 years or younger, accounting for 11.6% of all deliveries in the province. (PPIP database), which is in keeping with the global statistics. There were 269 deaths associated with these teenage pregnancies and a PNMR of 26.9 per 1000 births. For the same time period the PNMR was 22 per 1000 births for women aged 20-34 years. In that same year, 5.3% of the total perinatal deaths in South Africa occurred in girls under 20 years of age. (34). Interestingly, in Cameroon, while no difference was found in the stillbirth rate between teenage and non-teenage mothers, the early neonatal death rate varied significantly: 4.9% and 2.3% respectively. (22) Similarly, in India, death within the first 48 hours of life was higher in the teenage mother population. (28)

There is conflicting evidence regarding the risk of Caesarean section delivery in teenage pregnancies. While one study showed a significant increase in Caesarean sections amongst teenage deliveries (35), other authors have found a lower incidence (24) or no increase in risk (22). When comparing the younger to the older adolescent, it was found that the mothers less than 15 years of age were at greater risk of requiring a Caesarean section birth (23). In this study, half of the teenage delivery newborns that were admitted were born via Caesarean section with an increasing incidence with decreasing age. This difference however was not found to be statistically significant. Majority of the Caesarean sections that occur at Tygerberg Hospital are performed as an emergency procedure as opposed to an elective one. This in itself is an adverse maternal and fetal outcome and may be a marker for poor neonatal outcome as well.

The clinical outcomes of the newborns are not surprising. It is well established that teenage pregnancy is associated with preterm delivery and low birth weight (21–23,28,31). In this study, 82% of the admitted babies born to teenage mothers were premature and 83% were classified as low birth weight. Some authors have attributed the increased risk of teenage pregnancy related neonatal death to prematurity (32) and when this was adjusted for, no significant difference in risk of neonatal death was found amongst teenage pregnancies (10). Both neonatal deaths in this study were premature and had low birth weight: 26 and 33 weeks, and 770g and 2060g respectively.

In addition, the respiratory complications of premature deliveries are more likely to include hyaline membrane disease, as seen in this study, as opposed to transient tachypnoea of the newborn, a diagnosis more commonly made in term newborns.

Strengths and limitations

This study was conducted to describe the perinatal morbidity and clinical outcomes in admitted babies born to teenage mothers in a tertiary level care hospital. A strength of this study is the comprehensive description of these babies as well as the addition of antenatal and perinatal information. The information gathered and described is in keeping with what has previously been

described in the literature. However, at the time of completion, to the authors knowledge, no such research has been published within the South African setting.

This study has many limitations. The study setting is a tertiary care referral centre that manages complicated patients, thus, the results are not truly reflective of the rate of teenage pregnancy in the general population. Most teenage deliveries occur at primary (midwife obstetric units) and secondary level care (hospitals) facilities. In addition, only babies born in Tygerberg were included in this study. A prospective study should be conducted to determine the actual prevalence of teenage pregnancies and the outcome of their infants. Especially a comparison between admissions of babies born to teenage vs non-teenage maternal age groups would provide a more accurate assessment of the impact of teenage pregnancy on poor maternal and perinatal outcomes. This, together with a larger sample size is needed to assess statistical significance.

This study was designed and conducted to identify and describe the perinatal outcome of babies born to teenage mothers at a tertiary hospital in the Western Cape. In doing so, adverse perinatal maternal outcomes were also identified and notably, many of the teenage mothers had hypertensive related conditions and complications. As a known cause of prematurity and low birth weight, this most likely contributed to the high rate of these conditions that were found in the newborns. Also of note, there was a low rate of HIV prevalence amongst the young mothers and majority booked and attended antenatal care. All these factors influence the neonatal outcome, which in this study, found that one third of all teenage deliveries resulted in a neonatal admission, with 5 of those resulting in early neonatal death within the first seven days of life. Whether or not younger maternal age is a contributory factor to these outcomes was not within the scope of this study and further, larger studies are required to truly assess the impact that younger maternal age plays on adverse maternal and neonatal outcomes in the Western Cape.

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