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CLINICAL ARTICLE

Obstetrics

Adolescent maternal mortality at a district health services over a five year period in South Africa: A retrospective study

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Abstract

Objective: To determine the trend in adolescent maternal deaths and deliveries over a period of 5 years and 9 months (July 2014–March 2020) at the Ekurhuleni Health District in South Africa.

Methods: The present study was a retrospective review and secondary data analysis using data from the District Health Information System and clinical oversight data from the District Clinical Specialist Team. The study population was adolescent pregnant women aged 10–19 years who died at health facilities. Descriptive and inferential statistics were used for analysis.

Results: There was a total of 12 559 adolescent deliveries. Adolescent birth rate was lower than that of sub-Saharan Africa. Adolescent deaths ($n=37$) contributed to around 8% of the total maternal deaths. Deliveries (97%) and deaths (98%) were most common among women aged 15–19 years. Six (16%) women had a repeat pregnancy. A total of 21 (57%) had booked for antenatal care. There were few antenatal visits (mean $4 \pm$ SD 2.1). The main three causes of death were hypertension (35%) followed by hemorrhage (24%) and suicide (14%). Postpartum deaths (62%) were significantly (chi-square test, $P=0.02$) higher than antepartum deaths (38%). The majority (73%) of newborns were born alive which was significantly (chi-square test, $P=0.002$) higher than those which were stillborn (27%).

Conclusion: The main challenges were the high number of adolescent deliveries, repeat pregnancies, and preventable causes of death. Multidisciplinary collaboration involving obstetricians, midwives, pediatricians, school health services, social workers and psychologists is indispensable for comprehensive management, prioritizing pregnancy prevention among this vulnerable group.

KEYWORDS
adolescents, causes, delivery, mortality, pregnancy, South Africa

1 | INTRODUCTION

In the present study, adolescents were individuals aged 10–19 years, with 10–14 year olds categorized as very young adolescents.[1] The WHO has identified adolescent pregnancy as a global challenge, with 12 million adolescents reported to have given birth in 2019.[1] Worldwide, pregnancy-related complications are the leading cause of death among 15–19 year old adolescents.[2] The adolescent birth rate (ABR) has been declining globally, though at a very slow pace in sub-Saharan Africa (SSA), which had the highest ABR in 2022 (97 per 1000 women per year).[3] The total number of deliveries among 15–19-year olds and 10–14-year olds in SSA was 6 114 000 and 332 000, respectively in 2021.[3] As the overall population in SSA is increasing, the ABR is increasing correspondingly.[4] Few data is available on adolescent births in women aged 10–14 years old. In 2022 the ABR among 10–14 years olds in SSA was given at 4.6/1000 women per year, while the global average was 1.5/1000.[1] Strategies such as the Sustainable Development Goals (indicator 3.7.2) specifically emphasizes the prevention of adolescent pregnancy.[5] Despite this being a major health concern, very few studies are done on adolescent pregnancies in African countries, including South Africa, with most published studies being outdated, or not being multicenter, or with adolescents not separated into different age groups.[6–8]

The main objective of the present study was to determine the numbers of adolescent deliveries and adolescent maternal deaths, including causes of deaths, from July 2014 to March 2020 at the EHD.

2 | MATERIALS AND METHODS

Our study was conducted at the urban Ekurhuleni Health District (EHD) in the Gauteng Province of South Africa. The district has six hospitals (one district-level, four regional-level and one tertiary-level hospital), eight community health centers (CHC) and 88 primary healthcare (PHC) clinics. All health facilities carry out mandatory monthly reporting on maternal health indicators on the District Health Information System (DHIS),[9] including the number of deliveries among adolescents aged 10–14 years and 15–19 years, antenatal visit before 20 weeks of pregnancy and maternal deaths. Health facilities send summarized monthly reports of all maternal deaths to the Ekurhuleni District Clinical Specialist Team (DCST), who have a monitoring and oversight role.[10] This retrospective study used secondary data of all adolescent pregnant women who died at health facilities at the EHD over a period of 5 years and 9 months from July 2014 to March 2020. Maternal death is defined as death of a woman from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of the pregnancy, irrespective of the duration and site of the pregnancy.[11] For the purposes of this study, adolescents were divided into two groups, namely 10–14 years and 15–19 years. Data were collected from the DHIS, including population-level data on the female adolescent catchment population, and clinical oversight data from the DCST. The ABR was calculated as the annual number of births per 1000 adolescent girls per year.[3] Maternal deaths data included demographic information, such as age, and obstetric factors, such as parity, gestational age (GA) at first antenatal visit, number of antenatal visits, gestational period at death, GA at delivery, mode of delivery, newborn weight and outcome. Various data elements on adolescent pregnant women were not reported on DHIS until 2016, additionally reporting from the health facilities was subsequently irregular until July 2017. Despite this, incomplete data were included for analysis due to the importance of the data. The study was discontinued in March 2020 due to the disruptions of the COVID-19 pandemic. Permission was obtained from the Human Research Ethics Committee of University of Witwatersrand, Ekurhuleni District Research Committee and Gauteng Provincial Research Committee. Informed consent was not obtained because the study involved the retrospective collection of secondary data. Data were analyzed using NCSS PASS statistical software.[12] Descriptive statistics (numbers, percentages, means with standard deviations) were analyzed. Inferential statistics (chi-square test) were used to compare variables, with statistical significance defined as a *P* value of less than 0.05.

TABLE 1 Adolescent maternal deaths at the Ekurhuleni Health District during the study period.

Year[a]	Total maternal deaths, including adolescents (*n*)	Adolescents maternal deaths (*n*; % of total maternal deaths)	Adolescent (10–14 years) maternal deaths (*n*; % of total adolescent maternal deaths)	Adolescent (15–19 years) maternal deaths (*n*; % of total adolescent maternal deaths)
2014/2015 (1 year)	103	9 (8.7)	1 (11.1)	8 (88.9)
2015/2016 (1 year)	67	6 (9.0)	0 (0)	6 (100)
2016/2017 (1 year)	90	4 (4.4)	0 (0)	4 (100)
2017/2018 (1 year)	78	9 (11.5)	0 (0)	9 (100)
2018/2019 (1 year)	79	4 (5.1)	0 (0)	4 (100)
2019/March 2020 (9 months)	72	5 (6.9)	0 (0)	5 (100)
Total	489	37 (7.6)	1 (2.7)	36 (97.3)

[a]Year starts from July and ends in June.

Data source: DCST oversight data and DHIS.

TABLE 2 Adolescent deliveries at the Ekurhuleni Health District during the study period.

Year[d]	Total deliveries (adolescents and adults) (n)	10–14 years deliveries (n; % of total deliveries)	15–19 years deliveries (n; % of total deliveries)	Total adolescent deliveries (n)	Female adolescent population (10–14 years) (n)	Adolescent (10–14 years) birth rate	Female adolescent population (15–19 years)	Adolescent (15–19 years) birth rate	Adolescent (10–19 years) birth rate
2014/2015 (1 year)		a	a	a	114 022	-	131 186	-	-
2015/2016 (1 year)		a	a	a	119 040	-	131 545	-	-
2016/2017 (1 year)	16 303 (April–June)	5 (0.4) (April–June)[b]	1113 (99.6) (April–June)[b]	1118[b]	128 556	[0.2][c]	131 890	[33.8][c]	[17.2][c]
2017/2018 (1 year)	65 326	46 (1.4)	3332 (98.6)	3378	137 654	0.3	133 572	24.9	12.5
2018/2019 (1 year)	67 473	76 (1.7)	4320 (98.3)	4396	145 760	0.5	134 517	32.1	15.7
July 2019/March 2020 (9 months)	52 000	65 (1.8)	3602 (98.2)	3667	146 159	[0.6][c]	136 566	[35.2][c]	[17.3][c]
Total		192 (1.5)	12 367 (98.5)	12 559 (100)	-		-		

[a]Unreported.
[b]Three months data were incomplete due to incomplete reporting from health facilities, but available numbers were included.
[c]Available data has been extrapolated to 1-year data and is presented in square brackets.
[d]Year starts from July and ends in June.
Data sources: DHIS and DCST oversight data.

3 | RESULTS

A total of 37 pregnant/postpartum adolescents died in hospital during the study period, with the majority ($n=36$; 97%) aged 15–19 years. The percentage of adolescent maternal deaths to total maternal deaths varied over the years, from 4.4% in 2016/17 to 11.5% in 2017/18 (Table 1).

The adolescent maternal mortality ratio could not be calculated as disaggregated numbers of live births were not consistently reported, as the adolescent delivery numbers were not a reportable indicator until July 2016 and with subsequent irregular reporting by health facilities until July 2017. A large number of adolescents ($n=12\,559$) delivered from April 2017 to March 2020, primarily in the age group of 15–19 years (Table 2). Deliveries among the age group of 10–14 years were highest in 2018/19 ($n=76$). The adolescent (10–19 years) in-facility birth rate was 17.2, 12.5, 15.7 and 17.3 in 2016/17, 2017/18, 2018/19 and 2019/20, respectively, with the first and last being extrapolated values as the available data did not span the whole 12 month period. Total deliveries (including adolescents and adults) for the year of 2016/17 (April–June 2017), 2017/18, 2018/19 and 2019/20 (July 2019–March 2020) was 16 303, 65 326, 67 473 and 52 000, respectively. Therefore adolescent deliveries contributed to 6.9%, 5.2%, 6.5% and 7.1% of total deliveries in 2016/17, 2017/18, 2018/19, 2019/20, respectively (Table 2).

The demographic and obstetric history of the mothers is presented in Table 3. A total of 31 (83.8%) and six (16.2%) women were primigravidae and multigravidae, respectively. A total of 21 (57%) women had booked for antenatal care, with only few ($n=7$; 33%) having booked before 20 weeks of pregnancy. There were few antenatal visits (mean of 4 visits [SD 2.1]), with only one (5%) adolescent having had more than eight visits. Among 14 (38%) mothers who died antenatally, two (14.3%), five (35.7%) and seven (50.0%) died in the first, second and third trimesters, respectively. The 23 (62%) mothers who died postnatally included 11 (47.8%) women who delivered before 37 weeks, while 11 (47.8%) and one (4.3%) delivered at term and 41 weeks, respectively. A chi-square test showed that postpartum deaths were significantly ($P=0.020$) higher than the antepartum deaths. The number ($n=13$; 56.5%) of cesarean section deliveries was found to be higher than vaginal deliveries ($n=10$; 43.4%), although this was not significant (chi-square test, $P=0.376$). Regarding the 21 documented newborn birth weights, nine (42.8%) were less than 2500 g, while 12 (57.2%) were ≥ 2500, including one (4.8%) above 4000 g. In the 13 mothers who underwent cesarean section deliveries/hysterotomy, the most common indication was hypertension-related complications ($n=5$; 38.5%), followed by prolonged labor ($n=4$; 30.8%), while additional indications were twins ($n=2$; 15.4%), fetal distress ($n=1$; 7.7%) and prolonged rupture of membranes at term ($n=1$; 7.7%). The majority of newborns were born alive ($n=16$; 72.7%), which was significantly (chi-square test, $P=0.002$) higher than being stillborn ($n=6$; 27.3%) (Table 3).

Hypertension was the most common cause of death ($n=13$; 35.1%), followed by hemorrhage ($n=9$; 24.3%), suicide ($n=5$; 13.6%), sepsis ($n=4$; 10.8%) and medical disorders ($n=2$; 5.4%), while in four cases

TABLE 3 Demographic and obstetrics factors of the adolescent maternal deaths ($N = 37$).

Period[a]	Hypertension (*n*: %)	Hemorrhage (*n*: %)	Suicide (*n*: %)	Sepsis (*n*: %)	Medical (*n*: %)	Undetermined (*n*: %)	Total (*n*: %)
2014/2015 (1 year)	2 (22.2)	4 (44.4)	1 (11.1)	0 (0.0)	1 (11.1)	1 (11.1)	9 (24.3)
2015/2016 (1 year)	2 (33.3)	1 (16.7)	1 (16.7)	1 (0.0)	1 (16.7)	0 (0.0)	6 (16.2)
2016/2017 (1 year)	1 (25.0)	1 (25.0)	1 (25.0)	0 (0.0)	0 (0.0)	1 (25.0)	4 (10.8)
2017/2018 (1 year)	5 (55.6)	1 (11.1)	0 (0.0)	2 (22.2)	0 (0.0)	1 (11.1)	9 (24.3)
2018/2019 (1 year)	1 (25.0)	0 (0.0)	1 (25.0)	1 (25.0)	0 (0.0)	1 (25.0)	4 (10.8)
2019/March 2020 (9 months)	2 (40.0)	2 (40.0)	1 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (14.0)
Total	13 (35.1)	9 (24.3)	5 (13.6)	4 (10.8)	2 (5.4)	4 (10.8)	37 (100)

[a]Year starts from July and ends in June.

(10.8%) the cause of death was undetermined (Table 4). Hypertension and hemorrhage were common causes of deaths throughout the study period, while suicidal and sepsis deaths were more sporadic, including no suicidal and sepsis deaths for 1 and 3 years, respectively. Among 13 hypertensive deaths, 11 (84.6%) died due to complications of eclampsia. Among the nine hemorrhagic deaths, two-thirds ($n = 6$; 66.7%) and one-third ($n = 3$; 33.3%) had postpartum hemorrhage following cesarean and vaginal delivery, respectively, with no statistically (chi-square test, $P = 0.342$) significant difference between the mode of the delivery and its relation to PPH. The five suicidal deaths included three (60%) with organophosphate poisoning, one (20%) with drug overdoses and one (20%) with burns. In terms of the four sepsis related deaths, three (75%) adolescents had puerperal sepsis following cesarean section and another (25%) had a septic miscarriage, while the two deaths due to medical reasons included meningitis ($n = 1$) and peripartum cardiomyopathy ($n = 1$). Among four (10.8%) unknown causes, two adolescents were brought in dead to the hospitals by relatives, with histories suggesting acute collapse followed by rapid death, while another woman with no clinical history, was unconscious on arrival, with subsequent unsuccessful resuscitation. The fourth adolescent underwent in-facility induction of labor for being postdates, with subsequent acute collapse and death despite resuscitation. For all four women the final causes of death remained unknown as postmortem examinations were not performed (Table 4).

4 | DISCUSSION

Our study was undertaken to determine the state of adolescent maternal health, particularly maternal deaths and deliveries, over a five-year and 9 months period (July 2014–March 2020) at a South African district health service that included six hospitals, eight CHCs and 88 PHC clinics. Large numbers ($n = 12\,559$) of adolescent deliveries were an important finding, with the number of deliveries per year varying between $n = 3667$ to $n = 4396$. There were increasing numbers ($n = 46$ to $n = 76$) of deliveries among 10–14 year olds during the study period while it was highest ($n = 76$) in 2018/19 and lowest ($n = 46$) in 2017/18, a small but important subset of adolescents.

Adolescents contributed to around 8% of the total maternal deaths, which is of concern, while adolescents in the age group 10–14 years contributed to about 3% of the adolescent maternal deaths which is a new and an important finding as it was not reported previously in other studies. The majority of pregnant adolescents ($n = 14$; 67%) booked late (after 20 weeks' gestation) for antenatal care, and almost all ($n = 20$; 95%) had few (<4) antenatal visits. The high percentage ($n = 6$; 16%) of repeat pregnancy is additionally of great concern.

The present study has both similarities and differences to the few other studies conducted in African countries and one unpublished Master of Medicine thesis from South Africa.[6,8,13–15] Previous studies in SSA and South Africa are mainly systematic reviews, including studies based on death notification forms, household surveys and vital registration data, but rarely included primary data from health institutions.[14,16] Additionally, few studies done at institutional level in other African countries are very old.[6,7,13]

The adolescent birth rate was lower in the current study than SSA (12.5–17.3 compared to 97 per 1000 adolescent women per year).[3] Similarly, the ABR among 10 to 14 year olds was lower than previously reported from SSA (0.03–0.52 compared to 4.6 young adolescent women per year).[1] The comparatively lower ABR in this study is a satisfactory finding, with this being an important indicator which should be reported on regularly. No other South African study mentioning the ABR was identified.

Adolescents contributed to 8% of total maternal deaths, which was lower than the 13% to 22% previously reported from other African countries,[6,7,14] but slightly higher than the 6% previously reported from South Africa.[12] Very young adolescents (10–14 years) contributed 3% of the total adolescent maternal deaths, which was not comparable to other research, as this has previously not been reported on within the African context.[6–8,13–15]

Hypertension was the most common cause of adolescent maternal death, similarly to findings from a previous South African as well as other African studies.[7,8,13] Two other studies in Mozambique and South Africa, on the contrary, identified malaria and injuries as the most common causes of death, respectively.[6,16] Mozambique is an endemic malaria area[17] and the South African study used death notification forms of antepartum deaths only.[16] Hemorrhage accounted for 24% ($n = 9$) of deaths, similar to the 27% found in the Mozambican study,[6] but much higher than the 3% found in

TABLE 4 Primary causes and trend in maternal deaths at the Ekurhuleni Health District ($N = 37$).

Variable		N	Result
Maternal age (years)	Mean ± SD	37	17 (1.4)
Parity	Median [IQR]	37	0 [0]
Primigravida			
Yes	*N* (%)	37	31 (83.8%)
Attended antenatal care			
Yes	*N* (%)	37	21 (56.8%)
Gestational age at first antenatal visit (weeks)	Mean ± SD	21	21 (4.1)
Number of antenatal visits	Mean ± SD	21	4 (2.1)
Gestational period at maternal death			
Antepartum	*N* (%)	37	14 (37.8)
Intrapartum			0 (0.0)
Postpartum			23 (62.2)
Trimester of maternal death for antepartum deaths			
First trimester	*N* (%)	14	2 (14.3)
Second trimester			5 (35.7)
Third trimester			7 (50.0)
Gestational age at delivery (weeks)	Mean ± SD	23	35 (4.7)
Mode of delivery			
Vaginal delivery	*N* (%)	23	10 (43.5)
Cesarean section			12 (52.2)
Hysterotomy			1 (4.3)
Fetal/newborn outcome[a]			
Alive	*N* (%)	22	16 (72.7)
Stillborn			6 (27.3)
Newborn weight[b] (g)	Mean ± SD	21	2342 (924)
Birth weight category[b]			
<2500 g	*N* (%)	21	9 (42.8)
≥2500 g			12 (57.2)

Abbreviations: IQR, interquartile range; SD, standard deviation.

[a]Outcome was not known for one newborn.

[b]Weight was not documented for two newborns.

Data source: DHIS and DCST oversight data.

a previous South African study[13] and the 9% found in a Nigerian study.[7] Sepsis contributed to 11% ($n = 4$) of deaths, which is higher than the percentages found in a previous South African (6%)[13] and Nigerian (3%) study[7] and lower than a Mozambican study (15%).[6] Suicide contributed to 14% ($n = 5$) of deaths, a finding only previously reported in one South African study, where it contributed to less than 1% (0.7%) of deaths, although in that study death notification forms of only antepartum deaths were used as source documents, which may have been inaccurate in this regard.[16] Medical disorders, on the other hand, contributed to 5% ($n = 2$) of deaths, much lower than the 42% reported in a previous South African study in which pulmonary tuberculosis was the most common medical disorder (18%).[13] This might indicate a reduction in deaths due to pulmonary tuberculosis. Just more than half of our study participants ($n = 21$; 57%) were booked antenatally, which was lower than reported in a previous South African study (67%),[13] while on the other hand all mothers were unbooked in the Nigerian study.[7] Newborn outcomes were not mentioned in other studies, while most ($n = 16$; 73%) of the newborns in this current study were born alive, which could mean that most mothers became critically ill only after delivery and timeous delivery of critically ill antenatal mothers was conducted. Low birth weight of the newborn was common ($n = 9$; 43%), while birth weight was not discussed in other studies.

The major strength of the present study is that it is the first study in Africa on adolescent maternal deaths from an entire district health service, including all levels of institutions within the public health care sector, from primary clinics to the tertiary hospital, therefore reflecting on the overall situation of adolescent maternal health within the district. Additionally the study included a relatively long period, which assisted in determining the numbers of deliveries and deaths over time. As adolescents aged 10–14 years were analyzed separately, important information on this group of very young adolescents was provided.

The major limitation was the incomplete data resulting from inconsistent reporting from the health facilities. Maternal deaths were analyzed by using secondary data and not the patient files as source documents, which might have been more accurate. Unknown causes of deaths were also a limitation.

5 | CONCLUSION

Our study revealed lower adolescent birth rates and mortality in contrast to previous reports from SSA. Noteworthy challenges included high number of adolescent deliveries including a small increase in deliveries among 10–14 years, repeat adolescent pregnancies, and suicides as a new important cause of death. Multidisciplinary collaborative efforts involving obstetricians, midwives, pediatricians, school health services, social workers and psychologists are indispensable for comprehensive management, prioritizing pregnancy prevention. We recommend innovative strategies such as dedicated adolescent clinics and home contraceptive services, coupled with investments in adolescent-friendly health services, encompassing staff, infrastructure, and medication. Further research on adolescent pregnancy in South Africa and SSA is imperative for precise insights and strategic planning to enhance healthcare prevention services for this vulnerable population.

AUTHOR CONTRIBUTIONS

Jayati Kusari Basu: Conception. Jayati Kusari Basu, Aimee Stewart, Jeffrey Wing, Ute Feucht and Debashis Basu: Planning the study. Jayati Kusari Basu: Performing the study. Debashis Basu and Jayati Kusari Basu: Study analysis. Aimee Stewart and Jeffrey Wing: Supervised the study. Jayati Kusari Basu: Writing the original draft. Jayati Kusari Basu, Aimee Stewart, Ute Feucht, Jeffrey Wing and Debashis Basu: Writing–review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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