Prevalence and factors associated with adverse pregnancy outcomes in South Africa: Evidence from the 2016 Demographic and Health Survey

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Background. Adverse pregnancy outcomes are an important indicator of the overall health of a population and the socioeconomic development of a country.

Objectives. To determine the prevalence and factors associated with adverse pregnancy outcomes among women of reproductive age in South Africa, and to recommend strategies to reduce the burden of these outcomes.

Methods. We conducted a secondary data analysis on women of reproductive age using data from the nationally representative, population-based, cross-sectional 2016 South Africa Demographic and Health Survey (SADHS). We described the sociodemographic characteristics of the study participants and determined the prevalence and factors associated with adverse pregnancy outcomes using the multivariable logistic regression model. We adjusted all our analyses for complex survey sampling using survey weights.

Results. There were 8 514 women of reproductive age, of whom 41.2% had fallen pregnant during the 5-year period preceding the survey. The majority (70.9%) were of age 20 - 34 years, 78% had secondary education, 61.6% were unemployed, 65% were from urban areas, and more than 40% of these women were currently living with a man, while 51.5% reported that they had never been in a union. The prevalence of adverse pregnancy outcomes was 14.6% (95% CI 13.2 - 16.1%). The odds of experiencing adverse pregnancy outcomes were significantly higher for those aged 35 - 49 years (adjusted odds ratio (aOR) 7.41, 95% CI 3.46 - 15.85) or 20 - 34 years (aOR 2.07, 95% CI 1.02 - 4.18), compared with those aged 15 - 19 years. Women who were currently in a union/living with a man (aOR 1.85, 95% CI 1.41 - 2.43) or formerly in a union/living with a man (aOR 2.66, 95% CI 1.64 - 4.29), compared with those who had never been in a union, had higher odds of adverse pregnancy outcomes. Contrarily, adverse pregnancy outcomes were lower with each additional child delivered or ever born (aOR 0.66, 95% CI 0.58 - 0.75).

Conclusions. We report a high prevalence of adverse pregnancy outcomes among women of reproductive age in South Africa. We recommend addressing factors such as maternal age and currently/formerly living with a man within interventions to reduce the burden of adverse pregnancy outcomes in South Africa.

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Adverse pregnancy outcomes are outcomes other than normal live birth, which include stillbirth, preterm birth, neonatal mortality, maternal mortality and low birthweight, amongt others.[1,2] They can contribute significantly to physical and psychological health issues that may arise in new-borns and their mothers.[1] According to the United Nations Inter-agency Group for Child Mortality Estimation, approximately 9 million women and children die each year during pregnancy and around the time of birth.[3] The World Health Organization (WHO) reported that approximately 47% of all deaths in children under five years of age occur during the neonatal period.[4] The global disease burden of stillbirths and neonatal mortality is approximately 7%, which is two times higher than the burden of HIV/AIDS.[5]

Approximately 2.6 million stillbirths occurred globally in 2015.[6] Furthermore, an estimate of one million stillbirths have been reported in sub-Saharan Africa (SSA), which is more than double that of developed countries.[6] Evidence on the prevalence of adverse pregnancy outcomes in South Africa can be found in a study by Bello *et al.*, where the prevalence of adverse pregnancy outcomes was reported at 13%.[7] In Zimbabwe, the prevalence of stillbirths and early neonatal deaths was 15.6%.[8] The high prevalence of adverse pregnancy outcomes has also been reported in other African countries.[9,10]

It is evident that adverse pregnancy outcomes pose a substantial burden of disease and a great risk to public health. Therefore, reducing the burden of adverse pregnancy outcomes is of great importance. For example, reducing maternal mortality is one of the targets of Sustainable Development Goal (SDG) number 3. In South Africa, the National Development Plan (NDP) aims to achieve an infant mortality rate that is less than 20 deaths per 1 000 live births and an under-5 mortality rate of less than 30 per 1 000 by 2030. Goal number 3 of the health goals towards the 2030 vision of this plan is concerned with reducing maternal, infant and child mortality.[11]

Information on stillbirths, neonatal deaths and other adverse pregnancy outcomes as well as their contributing factors is not only key in guiding interventions and policies, but is also useful in tracking progress towards achieving the SDGs.[12] Factors associated with adverse pregnancy outcomes can be divided into several categories, including maternal health, history of previous pregnancies, health systems and sociodemographic factors.[8,13,14] Factors such as marital status, maternal education, maternal age and mode of delivery, among others, have been found to be significantly associated with stillbirth.[15] Low birthweight has been associated with factors such as multiple births, healthcare utilisation, community and wealth index.[16] In Ethiopia, women's autonomous healthcare-related decision-making, maternal age and

place of delivery, among others, have been associated with neonatal mortality.[17]

Data on the burden of adverse pregnancy outcomes and their associated risk factors in SSA are scanty and yet are needed to guide interventions.[8,9] The greater burden of adverse pregnancy outcomes is in Africa,[18] and understanding the associated factors may help to reduce this burden.

Objectives

The present study explored the prevalence and factors associated with adverse pregnancy outcomes among women of reproductive age in South Africa, using data from the 2016 Demographic and Health Survey (DHS).

Methods

Study design and setting

This was a secondary data analysis of South Africa's 2016 DHS data set, a nationally representative, population-based, cross-sectional survey.[19] The DHS Program has facilitated the global understanding of health and population trends in developing countries by providing technical assistance to more than 400 surveys in 90 countries since the year 1984. These national surveys are typically conducted every five years, and they cover data on maternal and child health, family planning, fertility, HIV/AIDS, gender, malaria and nutrition.[20] This DHS was carried out in all nine provinces of South Africa, including urban and non-urban areas. Survey data collection took place from 27 June 2016 to 4 November 2016.

Study population and sampling

The study population consisted of women of reproductive age (15 - 49 years) who were permanent residents or visitors of the households selected for interviews and who took part in the 2016 South Africa Demographic and Health Survey (SADHS). A stratified, two-stage sample design was followed. The sampling frame used for the survey was the Statistics South Africa Master Sample Frame, created using the 2011 population census. A probability proportional to size sampling of primary sampling units was used at the first stage, followed by a listing operation which served as a sampling frame for the second stage. At the second stage, a systematic random sampling of dwelling units was used. As a result, 750 primary sampling units were selected from the 26 sampling strata at the first stage and, in the second stage of selection, 20 dwelling units were chosen per cluster. Every household within a dwelling unit was eligible for interviews. The number of households that were successfully interviewed was 11 083, and 8 514 interviews were completed with eligible women. More details on sampling can be found in the SADHS 2016 report.[19] Among the 8 514 women interviewed for the 2016 SADHS, only 3 507 were eligible for the present study.

Measurements

Study outcome

The main outcome of interest was experiencing an adverse pregnancy outcome, defined as the participant ever having a pregnancy that terminated in a miscarriage, stillbirth or abortion or otherwise did not result in a live birth. The participants were asked whether they had ever had a terminated pregnancy, and the responses were either 'Yes' or 'No'; therefore the outcome variable was binary. The reported adverse pregnancy outcomes were based on pregnancies in the five years preceding the survey.

Predictor variables

The potential factors associated with adverse pregnancy outcomes include the age category (15 - 19 years, 20 - 34 years, 35 - 49 years), highest education level (No education, Primary, Secondary or Higher education), employment in the past 12 months (Not employed, Employed), marital status (Never in a union, Currently in a union/living with a man, Formerly in a union/living with a man), region (Western Cape, Eastern Cape, Northern Cape, Free State, KwaZulu-Natal, North West, Gauteng, Mpumalanga, Limpopo), place of residence (Urban, Rural), and number of children delivered or ever born.

Data management and analysis

The dataset is accessible via the DHS Program website (https://dhsprogram.com/data/available-datasets.cfm). We used descriptive statistics to summarise the adverse pregnancy outcome cases by characteristics, which were expressed as frequencies and percentages with 95% CIs for each category. Univariate analysis of each predictor variable against the outcome variable was done first. Manual backward elimination procedure was then used to enter variables with p-values <0.1 in the univariate analysis into the multivariable logistic regression model. The results were presented as crude (OR) and adjusted odds ratios (aOR), with their respective 95% CIs and p-values. A p-value <0.05 was used to indicate statistical significance. All statistical analyses were carried out using STATA version 14 and adjusted for complex survey design using survey weights.

Ethical considerations

The study was approved by the University of Pretoria's Faculty of Health Sciences Research Ethics Committee (Protocol code 104/2022 and approval date 13 April 2022). We sought permission to use DHS data from the DHS Program via their website and agreed to all standards and laws applicable in accessing and utilising DHS data. The SADHS was ethically approved by the South African Medical Research Council (SAMRC) Ethics Committee and the Inner-City Fund (ICF) Institutional Review Board.[19]

Results

Demographic characteristics

A total of 8 514 women aged 15 - 49 years participated in the 2016 SADHS. Only 3 507 women (41.2%) had fallen pregnant during the 5-year period preceding the survey. Most of these women (70.9%) were aged 20 - 34 years. More than three-quarters of these women had secondary education (78%). About three in every five women were unemployed (61.6%). The majority of women were from urban areas (65%). More than 40% of these women were currently living with a man while 51.5% reported that they had never been in a union. The mean (standard deviation (SD)) age at first birth was approximately 20 (4) years and each woman had on average given birth to two children (Table 1).

Adverse pregnancy outcomes

Of the 3 507 women who were pregnant in the 2016 DHS, a total of 512 (14.6%; 95% CI 13.2 - 16.1) experienced an adverse pregnancy outcome (i.e., ever having a pregnancy that terminated in a miscarriage, stillbirth or abortion or otherwise did not result in a live birth).

Factors associated with adverse pregnancy outcomes

Among the study participants, those aged 35 - 49 years had higher odds of adverse pregnancy outcomes than those aged 15 - 19 years (OR 4.43, 95% CI 2.10 - 9.31, p<0.001). This association remained significant after adjusting for potential confounders (aOR 7.41, 95%

Table 1. Sociodemographic characteristics of women aged 15 - 49 years, who fell pregnant in the 2016 SADHS

Characteristic	Category	*n*	Percent (%)	95% confidence interval
Age in years	15 - 19	214	5.3	4.5 - 6.2
	20 - 24	785	22.4	20.7 - 24.1
	25 - 29	937	27.3	25.4 - 29.3
	30 - 34	744	21.3	19.5 - 23.2
	35 - 39	475	14.2	12.8 - 15.7
	40 - 44	277	7.4	6.4 - 8.6
	45 - 49	75	2.2	1.7 - 2.9
Highest education level	No education	55	1.5	1.0 - 2.1
	Primary education	324	8.1	6.9 - 9.4
	Secondary education	2 750	78.2	76.2 - 80.2
	Higher education	378	12.2	10.5 - 14.2
Employment status	Not employed	2 217	61.6	59.1 - 64.0
	Employed	1 290	38.4	36.0 - 40.9
Marital status	Never in a union	1 910	51.5	49.2 - 53.7
	Currently in a union/living with a man	1 430	44.3	41.9 - 46.6
	Formerly in a union/living with a man	167	4.2	3.5 - 5.3
Region	Western Cape	224	9.6	8.1 - 11.3
	Eastern Cape	432	10.9	9.5 - 12.5
	Northern Cape	288	2.0	1.7 - 2.2
	Free State	327	4.8	4.2 - 5.6
	KwaZulu-Natal	539	18.4	16.2 - 20.8
	North West	405	7.9	5.8 - 10.7
	Gauteng	361	27.8	24.7 - 31.0
	Mpumalanga	480	9.0	7.5 - 10.7
	Limpopo	451	9.6	8.4 - 11.1
Place of residence	Urban	1 885	65.0	62.1 - 67.8
	Rural	1622	35.0	32.2 - 37.9

CI 3.46 - 15.85, $p<0.001$). Although not statistically significant at univariate analysis, those who were 20 - 34 years old had higher odds of adverse pregnancy outcomes than those aged 15 - 19 years (OR 1.86, 95% CI 0.90 - 3.82, $p=0.093$). This association became significant after adjusting for potential confounders (aOR 2.07, 95% CI 1.02 - 4.18, $p=0.043$) (Table 2).

Participants who were currently in a union/living with a man had higher odds of adverse pregnancy outcomes than those who had never been in a union (OR 1.83, 95% CI 1.40 - 2.39, $p<0.001$). This factor remained significant after adjusting for potential confounders (aOR 1.85, 95% CI 1.41 - 2.43, $p<0.001$). Those who were formerly in a union/living with a man had higher odds of adverse pregnancy outcomes than those who had never been in a union (OR 2.40, 95% CI 1.51 - 3.81, $p<0.001$). This factor remained significant after adjusting for potential confounders (aOR 2.66, 95% CI 1.64 - 4.29, $p<0.001$). (Table 2).

For each subsequent child delivered or ever born, the odds of adverse pregnancy outcomes decreased by 11.6% (OR 0.89, 95% CI 0.80 - 0.996, $p=0.041$). This factor remained significant after adjusting for potential confounders (aOR 0.66, 95% CI 0.58 - 0.75, $p<0.001$). Highest education level, employment status, region and place of residence were not significantly associated with experiencing adverse pregnancy outcomes. (Table 2).

Discussion

The objective of this study was to evaluate the prevalence and factors associated with adverse pregnancy outcomes in South Africa among women aged 15 - 49 years, using the 2016 DHS data. Studies on the prevalence of adverse pregnancy outcomes in South Africa are limited and existing studies are mostly disease-specific and usually not representative of the entire population,[7] which may not allow comparison with other nations and global estimates. A study done in South Africa on adverse pregnancy outcomes did not include analysis of the associated factors.[7] We found the prevalence of adverse pregnancy outcomes to be 14.6% of the 3 507 women who participated in the survey and had ever been pregnant. We found that older age (20 - 49 years), compared with the 15 - 19-year-olds, and living with a man, were significant risk factors for experiencing an adverse pregnancy outcome, while parity was significantly associated with decreased odds of experiencing adverse pregnancy outcomes.

The high prevalence of 14.6% is comparable with the prevalence of adverse pregnancy outcomes in South Africa (13%) in 2010[7] and Zimbabwe (15.6%) in 2014.[8] In Ethiopia, the pooled prevalence of adverse fetal outcomes was 26.9% in 2020.[21] The present study's adverse pregnancy outcome prevalence is lower compared with the above-mentioned countries, as well as countries such as Lesotho, the Congo and Liberia, among others, as reported in a study by Tamirat *et al.*[9] This finding could be attributed to differences in socio-economic status and maternal healthcare services utilisation and accessibility between the countries.[9]

We found a strong association between advanced maternal age (35 - 49 years) and adverse pregnancy outcomes. This could be attributed to increased risk of stillbirth, miscarriage, pre-term birth, and chromosomal abnormalities, among others, which are common in women who give birth over the age of 35, even though the magnitude of the risk may be small in most cases.[22] This finding is consistent with results from previous studies.[23,24] It may be particularly important to provide appropriate maternal health services such as counselling and screening to pregnant women of older age groups in order to reduce the risk of these unfavourable outcomes.[23,24]

Women who were 20 - 34 years of age had double the odds of experiencing an adverse pregnancy outcome, compared with the 15 - 19 years age group, after adjusting for potential confounders. Maternal age over 25 years has been linked but not limited to the

Table 2. Factors associated with adverse pregnancy outcomes among women of 15 - 49 years of age who participated in the 2016 SADHS

			Univariate			Multivariate		
Variable	**Category**	***n***	**OR**	**95% CI**	***P*-value**	**Adjusted OR**	**95% CI**	***P*-value**
Age group in years	15 - 19	214	Ref					
	20 - 34	2 466	1.86	0.90 - 3.82	0.093	2.07	1.02 - 4.18	0.043
	35 - 49	827	4.43	2.10 - 9.31	<0.001	7.41	3.46 - 15.85	<0.001
Highest education level	No education	55	Ref					
	Primary	324	1.03	0.44 - 2.42	0.944			
	Secondary	2 750	0.87	0.41 - 1.83	0.710			
	Higher education	378	1.31	0.59 - 2.91	0.531			
Employment status	Not employed	2 217	Ref					
	Employed	1 290	1.47	1.15 - 1.89	0.002			
Marital status	Never in a union	1 910	Ref					
	Currently in a union/living with a man	1 430	1.83	1.40 - 2.39	<0.001	1.85	1.41 - 2.43	<0.001
	Formerly in a union/living with a man	167	2.40	1.51 - 3.81	<0.001	2.66	1.64 - 4.29	<0.001
Region	Western Cape	224	Ref					
	Eastern Cape	432	0.65	0.44 - 0.96	0.029			
	Northern Cape	288	0.52	0.30 - 0.90	0.019			
	Free State	327	0.52	0.31 - 0.87	0.014			
	KwaZulu-Natal	539	0.54	0.36 - 0.81	0.003			
	North West	405	0.92	0.62 - 1.36	0.674			
	Gauteng	361	0.67	0.44 - 1.01	0.055			
	Mpumalanga	480	0.82	0.53 - 1.27	0.374			
	Limpopo	451	0.45	0.28 - 0.74	0.002			
Place of residence	Urban	1 885	Ref					
	Rural	1 622	0.73	0.58 - 0.92	0.008			
	OR							
Age at first birth	1.04			1.003 - 1.67	0.033			
Number of children delivered	0.89			0.80 - 0.996	0.041	0.66	0.58 - 0.75	<0.001

development of gestational diabetes mellitus (GDM) due to being overweight or obese, which increases the risk of adverse pregnancy outcomes.[25] This connection may be a possible explanation for the increased risk of adverse pregnancy outcomes among women of this age group. Health education regarding diet, exercise and screening during pregnancy may help in reducing the risk of GDM-related adverse pregnancy outcomes.[25]

Women of reproductive age who were currently in a union/living with a man or formerly in a union/living with a man, had higher odds of experiencing an adverse pregnancy outcome, compared with those who were never in a union. This could be due to intimate partner violence within their relationship that may occur during pregnancy. Similar results have been found in other studies, for example in Ethiopia by Berhanie *et al.*[26] and in Ghana by Pool *et al.*[27] It is therefore important to provide information on the dangers of intimate partner violence during pregnancy to pregnant women and their partners.[26] Other than intimate partner violence, there could be further factors influencing adverse pregnancy outcomes, which may include the possibility of sexually transmitted infections and delayed initiation to antenatal care. In low-resource settings, women may need to seek permission from partners before visiting health facilities.

Our findings also revealed that parity is significantly associated with decreasing odds of experiencing adverse pregnancy outcomes. Although this finding is consistent with the results from a previous study by Ajong *et al.*,[28] it is not supported by sufficient evidence as several studies have found parity to be associated with increasing adverse pregnancy outcomes.[29-31]

Study limitations

Inferences on the causal relationship between the risk factors and the outcome cannot be made because of the cross-sectional nature of the study data. Information collected during the survey interviews is subject to information and recall bias, as some questions rely on self-reporting. Furthermore, information on critical explanatory variables such as maternal smoking, chronic diseases and obstetric history were missing. HIV/AIDS was not included in the analysis of factors associated with adverse pregnancy outcomes. In addition, a broader definition of adverse pregnancy outcomes was presented than that defined in the SADHS and therefore used in the analysis. The reported adverse pregnancy outcomes were based on pregnancies in the five years preceding the survey. Nonetheless, the use of a large sample of 3 507 women of reproductive age from the nationally representative population-based DHS data provides useful insights on adverse pregnancy outcomes in South Africa.

Conclusions

Overall, a relatively high prevalence of adverse pregnancy outcomes was found in this study. Our study suggests that older maternal age (20 - 49 years) and currently/formerly living with a man were significantly associated with adverse pregnancy outcomes, while parity was significantly protective of adverse pregnancy outcomes.

Our recommendations include providing quality maternal health services, particularly for women of older age as they may have underlying weight-related conditions during pregnancy. Increasing awareness on the dangers of intimate partner violence for pregnant

mothers and their partners may be beneficial. These factors may be important in reducing the burden of adverse pregnancy outcomes in the country. Reducing adverse pregnancy outcomes may accelerate progress towards achieving SDGs and South Africa's National Development Plan.

Future research may focus on the prevalence and associated factors of individual adverse pregnancy outcomes, which may be helpful in addressing targeted interventions to improve these outcomes. In addition to the observed correlations between adverse events and older age and relationship status, it is advisable to explore the influence of socioeconomic factors, as well as health-related variables such as cardiovascular and other non-communicable diseases. Furthermore, investigating potential links between adverse events and communicable diseases such as HIV, STIs and TB can provide valuable insights into the interplay between health conditions and adverse outcomes in the studied population. These avenues for future research merit exploration to comprehensively address the implications of the study's findings.

Declaration: Ethics approval and consent to participate

Ethical approval for this study protocol was sought from the University of Pretoria Faculty of Health Sciences Research Ethics Committee (Protocol code 104/2022 and approval date 13 April 2022).

This study is a secondary data analysis of publicly available and non-identifiable data. The ICF Institutional Review Board (IRB) approved procedures for Demographic and Health Surveys that are carried out following the relevant guidelines and regulations (e.g., Declaration of Helsinki). In particular, the ICF IRB ensures that the survey complies with the US Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46), while the host country IRB ensures that the survey complies with laws and norms of the nation (https://dhsprogram.com/Methodology/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm). The procedures do not, in any way, allow respondents, households or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to an enumeration area and each enumeration area has a primary sampling unit number in the data file, but the numbers do not have any labels to indicate their names or locations. Before each interview is conducted, an informed consent statement is read to the respondent, who may accept or decline to participate. More details on ethical approval for DHS datasets may be accessed from https://dhsprogram.com/Data/terms-of-use.cfm. Furthermore, we received authorisation to use the South African dataset from the DHS Program provided as supplementary material.

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