

# Predictors of Teenage Pregnancy in Zambia Between 2007-2018

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## Research Article

**Keywords:** Adolescent pregnancy, predictors, sexual and reproductive health services, teenage pregnancy

**Posted Date:** July 7th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-640287/v1>

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## Abstract

### Background:

In Zambia, 29% of adolescents aged 10-19 have begun childbearing. Early childbearing has been shown to have detrimental social and medical outcomes. As far as we are aware, there has been no study in Zambia that has investigated the drivers of teenage pregnancies over a 10-year period. Using DHS data, we sought to determine predictors of teenage pregnancies among teenagers in Zambia between the years of 2007 and 2018.

### Methods:

We analyzed survey data of 11,194 adolescents from the 2007, 2014 and 2018 Demographic and Health Surveys (DHS), which are nationally representative. Analyses were conducted with Stata/SE software and we examined rates of teenage pregnancy based on multiple predictors of interest. Chi-square tests and multivariable logistic regression models were employed for statistical comparison using a p-value of 0.05 to indicate statistical significance.

### Results:

After exclusions, 11,194 adolescents under the age of 19 were included in our analysis, with a 29% prevalence of teenage pregnancy. Teenagers were more likely to become pregnant if they were married, had younger sexual debut, had less education, were illiterate, lived in rural areas, or were of the poorest wealth index than if they were not. Among adolescents with teenage pregnancies, utilization of sexual and reproductive health services among teen mothers significantly increased between 2007 and 2018. On multivariate analysis, teenage pregnancy was found to be significantly different given predictors when compared to the reference group, with significant effect modification due to marital status.

### Conclusion:

Our study identified significant demographic, intrapersonal, and socioeconomic factors that have impacted rates of teenage pregnancy in Zambia over the past 10 years. Understanding these drivers can inform programmatic interventions targeting reduction of teenage pregnancies.

## Background:

In Zambia, 29% of adolescent adolescents aged 10–19 have begun childbearing.<sup>1</sup> The rates of adolescent pregnancy are highest among married adolescents living in rural areas, with significant differences based on their home region.<sup>2</sup> Recent data has also shown that 39% of adolescents are married by the age 18, and 17% of adolescents have had their sexual debut by the age of 15.<sup>1</sup> The teenage pregnancy rates in Zambia are significantly higher than worldwide rates of 4.4%, warranting further investigation into specific predictors.<sup>3</sup>

Early childbearing has been shown to have detrimental social and medical outcomes for young adolescents. Complications during pregnancy and childbirth are the leading cause of death for 15–19 year old girls globally.<sup>4,5</sup> Further, adolescent mothers are more likely to have pregnancy complications such as eclampsia, puerperal endometritis, fistula and systemic infections when compared to older mothers.<sup>6,7</sup> Neonates born to adolescent mothers also have higher prevalence of low birth weight, preterm delivery and other severe neonatal outcomes.<sup>6</sup> Socio-culturally, adolescent pregnancy has been demonstrated to lead to premature education cessation and young marriage, leading to poverty, increased rates of domestic violence and poor health outcomes.<sup>6</sup> Teens who may want to avoid pregnancy are often unable to do so because of lack of adolescent sexual and reproductive health (ASRH) education and access to safe contraceptive and abortion care.<sup>8</sup> The government in Zambia has implemented ASRH education in primary and secondary schools over the last few years, but many adolescents still lack access.<sup>9</sup>

There have been several previous studies investigating predictors of adolescent pregnancy in Zambia and other developing countries that aimed to understand the high prevalence of teen pregnancy and how to reduce those rates. These studies have identified early sexual debut, limited knowledge and use of contraception, poverty, low access to ASRH services, lack of education, low literacy and transactional sex as significant predictors of increased rates of adolescent pregnancy. Adolescent marriage is ubiquitously associated with teenage pregnancy across all studies.<sup>4,6,8,10,11</sup> However, these studies have investigated the predictors of teenage pregnancies from a single time point. As far as we are aware, there has been no study in Zambia that has investigated the predictors of teenage pregnancies over a 10-year period. Using DHS data, we sought to determine predictors of teenage pregnancies among teenagers in Zambia between the years of 2007 and 2018. Identifying these predictors over this period of time will ultimately allow for discussions on progress related to what is working and what may need to be strengthened in terms of programmatic interventions targeting reduction of teenage pregnancies.

## Methods:

We conducted a retrospective study of survey data of 11,194 teenagers. This study used data from the 2007, 2014 and 2018 DHS nationally representative survey designed to provide up-to date information on fertility, family planning, infant and child mortality, maternal and child health, nutrition, spousal violence, and noncommunicable diseases in relation to demographic and other background characteristics of respondents.<sup>1</sup> The surveys adopted a quantitative cross sectional study design and were conducted through structured interviews. The four instruments were based on questionnaires developed by the Demographic and Health Surveys program and adapted to Zambia's specific data needs. However, for this study only female questionnaires were used. Institutional Review Board approval was obtained for the data used in this analysis.

Individuals were included in the study if they were currently pregnant or have had a child before, if they were considered emancipated minors/adults, were able to provide written informed consent to participate, resided in the area of interest, and were fluent in the local language used in the community.

Analyses were conducted with Stata/SE software (version 16.1; Stata corporation, College Station, TX). We examined rates of teenage pregnancy based on multiple predictors of interest. We defined teenage pregnancy as either having a child, being currently pregnant, or previously terminating a pregnancy in participants under the age of 19. Predictors of interest included marital status, age at first marriage, age at first sexual intercourse, education status, employment status, religion, literacy, wealth index, knowledge of contraceptives, contraceptive utilization, relationship to head of house, sex of head of house, unmet needs, partner's education level, partners age, ASRH utilization, history of partner violence, and knowledge of ASRH services.

Chi-square tests were employed for statistical comparisons and a p-value of less than 0.05 or 95% confidence intervals that did not include the null were used to indicate statistical significance. Further, we applied an additional identifying variable of year to each observation to analyze trends in certain variables over time in adolescents who experienced teenage pregnancy. These variables included knowledge of sexual and reproductive health services, history of physical violence, history of sexual violence, and utilization of sexual and reproductive health services.

Multivariable logistic regression models were used to examine the predictors of the outcome of teenage pregnancy. We presented three logistic regression models for comparison. Model 1 included all factors, model 2 included socioeconomic factors, and model 3 included interpersonal factors. For all models, we further adjusted for marital status as a potential effect modifier. As we were using survey data, we applied the Archer & Lemeshow F-adjusted mean residual test to assess goodness of fit.

## **Results:**

### Descriptive characteristics:

After exclusions, 11,194 adolescents between the ages of 15 and 19 were included in our analysis. Of these adolescents, 16% were married or cohabited, with 31% of those married before the age of 16. 51% of the entire sample had first sexual intercourse before the age of 16, 51% of adolescents had partners between the ages of 20–24, 73% lived in a household with a man as head of household, 7.3% had experienced physical violence, and 13% had experienced sexual violence. 44.9% of participants had less than secondary school education, 18% were currently employed and 23% were not able to read. 46% were living in urban areas, with 17% in Lusaka, and 26% in the richest wealth index. As composite variables, 98% of adolescents had knowledge of adolescent sexual and reproductive health services (ASRH), and 55% had utilized them in the past (Table 1).

Table 1  
Descriptive characteristics of study participants (N = 11,194)

Variable	Characteristics	N(%)
Marital status	0 = never married	9280 (83)
	1 = married or cohabitating	1767 (16)
	2 = divorced or separated	146 (1.3)
Age at first cohabitation (N = 975)	1 = < 16 years	594 (31)
	2 = 16–19 years	1318 (69)
Age at first sex (N = 2203)	1 = < 16 years	2668 (51)
	2 = 16–19 years	2515 (49)
Sex of household head	1 = Male	8194 (73)
	2 = Female	2999 (27)
Age of most recent partner N = 4198	1 = < 19 years	899 (21)
	2 = 20–24 years	2139 (51)
	3 = 25–29 years	615 (15)
	4 = 30–39 years	123 (2.9)
	5 = 40–49 years	422 (10)
Physical violence	0 = No	1365 (93)
	1 = Yes	108 (7.3)
Sexual violence (N = 757)	0 = No	1281 (87)
	1 = Yes	191 (13)
Employment status (N = 5162)	0 = Not currently working	9109 (82)
	1 = Currently working	2053 (18)
Place of residence (N = 5193)	1 = urban	5144 (46)
	2 = rural	6050 (54)
Region (N = 5193)	1 = Central	1076 (9.6)
	2 = Copperbe	1959 (18)
	3 = Eastern	1302 (12)
	4 = Luapula	805 (7.2)
	5 = Lusaka	1959 (17)
	6 = Muchinga	772 (6.9)
	7 = Northern	836 (7.5)
	8 = North west	710 (6.3)
	9 = Southern	1187 (11)
	10 = Western	587 (5.2)
Literacy (N = 5130)	0 = Cannot read	2575 (23)
	1 = Able to read parts of sentence	1515 (14)
	2 = Able to read whole sentence	7038 (63)
Wealth index (N = 5193)	1 = Poorest	1782 (16)
	2 = Poorer	1919 (17)
	3 = Middle	2107 (19)
	4 = Richer	2495 (22)
	5 = Richest	2891 (26)

Variable	Characteristics	N(%)
Knowledge of Sexual and Reproductive Health Services (SRH)	0 = No	223 (2)
	1 = Yes	10970 (98)
Utilization of ASRH services	0 = No	5027 (45)
	1 = Yes	6167 (55)

Bivariate analysis:

On bivariate analysis of demographic variables with teenage pregnancy, we found that many of the variables were significant predictors of teenage pregnancy (Table 2). There was a statistically significant difference in rates of teen pregnancy based on marital status ( $p < 0.001$ ) and the prevalence of teenage pregnancy was higher among married adolescents as compared to never married or divorced adolescents, with a prevalence of 90% among married participants compared to 17% of never married and 88% of divorced or separated adolescents. Teenage pregnancy was higher among adolescents who had sexual debut under the age of 16 (60%) compared with over the age of 16 (55%). 47% of teenagers with no education had teenage pregnancies, compared to 36% of those with primary education, 23% with secondary education and 12% of those with higher than secondary education, further illiterate teenagers were more likely to become pregnant than those who were able to read. Adolescents living in rural areas were more likely to have a teenage pregnancy (37%) than those living in urban areas (20%). When comparing strata of wealth index, the poorest individuals had the highest rates of teenage pregnancy. On bivariate analysis, a history of physical or sexual violence was not associated with a significant difference in teenage pregnancy between the groups.

Table 2  
Analysis of intrapersonal, institutional and policy Predictors with teenage pregnancy (N = 11,194)

Variable	Characteristics	No Teenage Pregnancy (%)	Teenage Pregnancy (%)	$\chi^2$	P-value
Marital status	0 = never married	7718 (83)	1562 (17)	4222.74	< 0.001
	1 = married or cohabitating	171 (97)	1596 (90)		
	2 = divorced or separated	18 (12)	128 (88)		
Age at first cohabitation	1 = < 16 years	6.2 (20)	94 (32)	13.0015	0.03
	2 = 16–19 years	12 (80)	88 (68)		
Age at first sex	1 = < 16 years	1055 (40)	1613 (60)	15.21	0.004
	2 = 16–19 years	1125 (45)	1390 (55)		
Highest education level	0 = No education	174 (53)	154 (47)	286.83	< 0.001
	1 = Primary	3007 (64)	1715 (36)		
	2 = Secondary	4690 (77)	1411 (23)		
	3 = Higher than secondary	35 (88)	4.7 (12)		
Employment status	0 = Not currently working	6839 (75)	2270 (25)	475.11	< 0.001
	1 = Currently working	1050 (51)	1002 (49)		
Place of residence	1 = urban	4116 (80)	1028 (20)	414.98	< 0.001
	2 = rural	3791 (63)	2259 (37)		
Region	1 = Central	743 (69)	333 (31)	1395.64	< 0.001
	2 = Copperbe	1581 (81)	378 (19)		
	3 = Eastern	813 (62)	489 (38)		
	4 = Luapula	561 (70)	244 (30)		
	5 = Lusaka	1583 (81)	376 (19)		
	6 = Muchinga	547 (71)	226 (29)		
	7 = Northern	596 (71)	240 (37)		
	8 = North west	446 (63)	264 (41)		
	9 = Southern	700 (59)	487 (41)		
	10 = Western	337 (57)	250 (43)		
Literacy	0 = Cannot read	1365 (53)	1210 (47)	542.76	< 0.001
	1 = Able to read parts of sentence	1075 (71)	440 (29)		
	2 = Able to read whole sentence	5425 (77)	1612 (23)		
Wealth index	1 = Poorest	976 (55)	805 (45)	911.66	< 0.001
	2 = Poorer	1182 (62)	737 (38)		
	3 = Middle	1338 (63)	769 (37)		
	4 = Richer	1799 (72)	696 (28)		
	5 = Richest	2612 (90)	279 (9.7)		
Sex of household head	1 = Male	5713 (70)	2481 (30)	12.76	0.012
	2 = Female	2194 (73)	805 (27)		
Age of most recent partner	1 = < 19 years	590 (66)	309 (34)	474.32	< 0.001
	2 = 20–24 years	667 (31)	1472 (69)		
	3 = 25–29 years	137 (22)	477 (78)		
	4 = 30–39 years	13 (10)	110 (90)		
	5 = 40–49 years	201 (48)	221 (52)		

Variable	Characteristics	No Teenage Pregnancy (%)	Teenage Pregnancy (%)	$\chi^2$	P-value
Knowledge of Sexual and Reproductive Health Services (SRH)	0 = No	169 (76)	55 (24)	2.74	0.26
	1 = Yes	7738 (71)	3232 (29)		
Physical violence	0 = No	115 (8.5)	1249 (92)	0.32	0.72
	1 = Yes	11 (10)	97 (90)		
Sexual violence	0 = No	114 (8.2)	1167 (91)	1.55	0.33
	1 = Yes	12 (6.2)	179 (94)		
Utilization of ASRH services	0 = No	4581 (91)	446 (8.9)	1896.37	< 0.001
	1 = Yes	3327 (54)	2840 (46)		

Trends in proportion of TP due to predictors of pregnancy over time:

Among adolescents with teenage pregnancies, knowledge of SRH services was significantly different by year with a chi-square of 58.02,  $p = 0.0014$ , however there was not a clear trend over time (Table 3, Fig. 1). Utilization of SRH services among teen mothers significantly increased between 2007 and 2018 with a  $p$ -value < 0.001. The prevalence of physical violence and sexual violence among adolescents with teen pregnancies was not significantly different by year, but there does appear to be a downward trend in both groups.

Table 3  
Trends in proportion of TP due to Predictors of pregnancy over time

Variable	2007	2014	2018	$\chi^2$	P-value
Knowledge of SRH	3.9 (87)	5.1 (48)	23 (2.5)	58.02	0.0014
No	443 (99)	1041 (99.52)	874 (97)		
Yes					
Utilization of SRH services	178 (40)	114 (11)	7 (8.6)	887.99	< 0.001
No	269 (60)	932 (89)	820 (91)		
Yes					
Physical violence	196 (91)	428 (91)	312 (95)	3.84	0.23
No	20 (9.1)	41 (8.8)	18 (5.5)		
Yes					
Sexual violence	191 (89)	402 (86)	287 (87)	1.19	0.63
No	25 (11)	68 (14)	43 (13)		
Yes					

Multivariable analysis:

In model 1, we found that after adjusting for all predictors, teenage pregnancy was found to be significantly different given predictors when compared to the reference group (Table 4). In this model, the only independent factors found to be statistically significant were having a female head of house, which resulted in fewer teen pregnancies (aOR 0.25, 95% CI 0.09–0.66), sexual and reproductive health services utilization (aOR 15.98, 95% CI 6.25–40.88) and living in either central (aOR 6.37, 95% CI 1.23–33.14) or western (aOR 0.18 0.03–1.01) regions of Zambia. After adjusting for effect modification of marriage status,  $p$ -values decreased across all variables, but none became significant. When calculating goodness of fit, the F-statistic was 194.06, with a  $p$ -value < 0.001, indicating a poor fit.

Table 4  
The associations between teenage pregnancy and demographic, intrapersonal, and socioeconomic factors.

Variable	Model 1			Model 1 effect modification			Model 2			Model 2 effect mod			Model 3		
	aOR	SE	P-value	aOR	SE	P-value	aOR	SE	P-value	aOR	SE	P-value	aOR	SE	P-value
Marital status															
Never Married	Ref			Ref			Ref			Ref					
Married or cohabitating	0.903	0.84	0.913				0.82	0.62	0.79	14.13	20.79	0.072			
Divorced or separated	1						1			1					
Age at first cohabitation															
<16 years	1.55	0.71	0.64	1.72	0.84	0.274	2.15	0.89	0.064	1.75E-13	3.83E-13	< 0.001			
16–19 years	Ref			Ref			Ref			Ref					
Age at first sex															
<16 years	1.41	0.62	0.6	1.3	0.6	0.573	1.21	0.45	0.61	3.44E+19	9.74E+19	< 0.001			
16–19 years	Ref			Ref			Ref			Ref					
Sex of household head															
Male	Ref			Ref			Ref			Ref					
Female	0.25	0.12	0.006	0.182	0.095	0.001	0.39	0.16	0.022	1.41	2.53	0.04			
Age of most recent partner															
<19 years	0.95	0.72	0.95	1.01	0.77	0.99	1.09	0.73	0.9	1.07	0.72	0.918			
20–24 years	Ref			Ref			Ref			Ref					
25–29 years	0.49	0.23	0.13	0.46	0.22	0.109	0.42	0.17	0.18	0.37	0.16	0.021			
30–39 years	1.97	1.33	0.314	2.56	1.82	0.187	0.91	0.6	0.88	3.84E-14	8.39E-14	< 0.001			
40–49 years	1.39	1.55	0.77	1.51	1.64	0.71	0.86	0.69	0.85	0.78	0.64	0.763			
Physical violence															
No	Ref			Ref											
Yes	0.47	0.34	0.29	0.38	0.28	0.184	0.46	0.34	0.3	2.60E+13	5.68E+13	< 0.001			
Sexual violence															
No	Ref			Ref											
Yes	1.83	1.32	0.4	2.87	2.13	0.16	1.82	1.14	0.34	7.03E-08	1.16E-07	< 0.001			
Highest education level															
No education	Ref			Ref									Ref		
Primary	0.91	0.79	0.949	1.19	1.03	0.84							0.98	0.15	0.907
Secondary	0.79	0.81	0.814	1.01	1.05	0.99							1.31	0.24	0.132
Higher													1.42	0.99	0.61
Employment status															
Not working	Ref			Ref									Ref		
Currently working	1.79	0.71	0.137	1.78	0.73	0.16							2.21	0.16	0

	Model 1			Model 1 effect modification			Model 2			Model 2 effect mod			Model 3		
Place of residence															
Urban	Ref			Ref						Ref					
Rural	0.8	0.44	0.686	0.74	0.42	0.56				0.8	0.92	0.05			
Region															
Central	6.37	5.35	0.028	5.74	4.9	0.04				1.01	0.14	0.95			
Copperbelt	1.98	1.37	0.323	1.51	0.99	0.52				0.86	0.13	0.32			
Eastern	5.72	5.64	0.078	4.51	4.35	0.12				0.98	0.14	0.91			
Luapula	4.25	5.22	0.24	3.76	4.92	0.31				0.66	0.1	0.008			
Lusaka	Ref			Ref						Ref					
Muchinga	1.13	0.84	0.875	1.18	0.94	0.83				0.7	0.11	0.023			
Northern	0.72	0.51	0.65	0.66	0.49	0.57				0.61	0.94	0.001			
North western	0.97	1.05	0.977	0.83	0.9	0.87				1.18	0.18	0.264			
Southern	1.41	1.1	0.66	1.48	1.25	0.65				1.45	0.26	0.038			
Western	0.18	0.157	0.052	0.14	0.14	0.04				1.31	0.2	0.082			
Literacy															
Cannot read				Ref						Ref					
Able to read parts of sentence	0.65	0.42	0.51	0.52	0.36	0.345				0.53	0.06	< 0.001			
Able to read whole sentence	1.07	0.55	0.9	1.06	0.57	0.901				0.4	0.4	< 0.001			
Wealth index															
Poorest	0.56	0.79	0.68	0.787	1.07	0.86				6.91	1.16	< 0.001			
Poorer	0.35	0.51	0.47	0.56	0.81	0.7				5.57	0.89	< 0.001			
Middle	0.15	0.2	0.152	0.21	0.27	0.23				5.3	0.8	< 0.001			
Richer	0.091	0.11	0.056	0.13	0.16	0.096				3.4	0.46	< 0.001			
Richest	Ref			Ref						Ref					
Knowledge of Sexual and Reproductive Health Services (SRH)															
No	Ref			Ref											
Yes	0.56	0.58	0.579	0.68	0.73	0.72									
Utilization of ASRH services															
No	Ref			Ref											
Yes	15.98	7.64	< 0.001	15.77	8.03	< 0.001									

In model 2, instead of adjusting for all variables, we adjusted for education, employment, place of residence, region, literacy status and wealth index. We found the model to be statistically significant with a p-value < 0.001. Employment status, living in a rural area, region, literacy, and wealth index were all found to significantly increase the likelihood of teenage pregnancy. Goodness of fit test resulted in an F statistic of 0.56 with a p-value of 0.811, indicating a well fit model. After effect modification with marital status, married individuals were more likely to become pregnant (aOR 34.94, 95% CI 10.18–119.93), and having secondary education became statistically significant once we adjusted for effect modification (aOR 1.79, 95% CI 1.03–3.09).

In model 3, we adjusted for intrapersonal factors of marital status, age at first marriage, age at first sex, sex of head of house, age of partner and history of physical and sexual violence. It showed that adolescents who lived in a household with a female as the head were less likely to get pregnant as compared to a

male head of household. Teenage adolescents who had a partner aged 25–29 were significantly less likely to get pregnant than the reference group of 19–24 (aOR 0.42, 95% CI 0.18–0.95). Effect modification by marital status showed significant association with age at first marriage, age at first sex, partner age of 25–29 and 30–39, history of physical violence and history of sexual violence. However, goodness of fit testing had a p-value < 0.001, indicating a poor fit.

## Discussion:

Our study identified significant demographic, intrapersonal, and socioeconomic factors that have impacted rates of teenage pregnancy in Zambia over the past 10 years. Findings suggest that marital status and early sexual debut still remain the most important factors driving adolescent pregnancy in Zambia. Teenage girls who had their first sexual encounter before the age of 16 were more likely to become pregnant when compared to those who had their first sexual encounter between the ages 16 to 19. Not surprisingly, teenage girls who are married have a higher likelihood of becoming pregnant, highlighting the importance of addressing the problem of child marriage.

A study from 2015 by the Population Council and UNFPA found that there were some districts that were considered as hotspots for child marriage. The districts included Isoka and Chama in Muchinaga Province and Masiti, Mpongwe and Lufwanyama on the Copperbelt. On the other hand, in the Western part of Zambia, girls were less likely to marry before age 18 (i.e., districts of Mongu, Lukulu, Senanga, Sesheke, and Shangombo).<sup>12</sup> While rates of child marriage are lower in Western Province at a macro level, when cases of teenage pregnancy do happen in this province, they are often associated with teenage pregnancy. In some communities, child marriage was viewed as a means to derive financial benefit, and which frequently resulted in teenage pregnancies and highlights the potential challenges associated with reducing child marriage.

Furthermore, significant differences are observed between girls from the poorest wealth index and those from the richer and richest wealth indices. Those from the poorest index were more likely to become pregnant compared to those in the richer and richest wealth indices. In addition, the likelihood of being pregnant among girls who experienced sexual violence was significantly higher compared to those who did not. These results concur with some studies that have postulated that sexual abuses place girls at higher risk of experiencing teenage pregnancy.<sup>13,14</sup>

Findings also indicate that girls who had experienced a teenage pregnancy were more likely to utilize SRH services compared to those who did not. This could be attributed to the fact that pregnant adolescents would be required to access SRH services such as antenatal care (ANC) and HIV testing from facilities. However, since the data were cross sectional, it is not known whether the utilization of services occurred before or after the pregnancy. Findings from the analysis also suggest that teenage girls who were currently working have higher odds of being pregnant compared to those who are not. From a multivariate analysis perspective, it is unclear why this is so, but we can speculate that perhaps due to the gender power dynamics in places of work, teenagers are coerced into having sexual relationships. It could also be that teenagers who work may have some associated risks for exposure to sexual activity, such as transactional sex related to daily expenses. However, there is a need to investigate further why this is the case.

The nature of the large representative sample size using DHS data and the time period from which we were able to abstract the data allows for robust results. Further, cross-sectional studies allow us to determine prevalence and associations of multiple exposures and outcomes.<sup>15</sup> Cross-sectional studies have several inherent limitations. We were unable to establish a temporal sequence of events because cross-sectional studies represent a snapshot in time. Further, DHS data often has a delay in publishing results, so it may not be a true reflection of the current situation. As many of our data came from self-reported surveys, we cannot say with certainty that we confounded for all variables because of the threat of misclassification bias or missing data. Considering all limitations, we believe the effect is minimal on our findings and our study is strong.

## Conclusion:

Given the significant findings in our study and its consistency with other studies of its kind, we conclude that there are significant predictors of teenage pregnancy in Zambia during the time range of 2007–2018. Understanding these predictors can help clinicians and policy makers better prevent teenage pregnancy and the associated adverse medical and socioeconomic outcomes. Given the significant contribution of socio-demographic predictors such as age and marital status, there is need to enhance efforts to ensure a zero-tolerance stance towards child marriage, which is already unlawful in Zambia. Future research on teenage pregnancy in Zambia should examine the effect of access to adolescent sexual and reproductive health services on teenage pregnancy.

## Declarations

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and materials: The datasets generated and/or analyzed during the current study are not publicly available due to IRB regulations but are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

Funding: There was no funding available for this project.

Authors' contributions: CP analyzed and interpreted the data for the project, in addition to doing most of the writing. NCM significantly contributed to the analysis and to the writing, in addition to editing and advising work. AL was a major contributor to editing the written manuscript for the project. MM contributed significantly as the PI on the project.

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## Figures

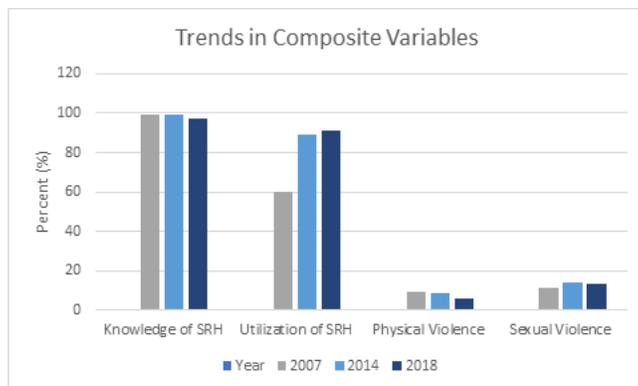


Figure 1

Trends in composite variables