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**Access to mass media and teenage pregnancy among adolescents in Zambia: a national cross-sectional survey**

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Access to mass media and teenage pregnancy among adolescents in Zambia: a national cross-sectional survey

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Abstract

Introduction Teenage pregnancies and childbirths are associated with negative health outcomes. Access to health information enables adolescents to make appropriate decisions. Therefore, we examined the association between access to mass media and teenage pregnancy in Zambia.

Methods Our study used weighted data from the Zambian Demographic and Health Survey (ZDHS) of 2018 for 3000 adolescents aged 15 to 19 years. Multistage stratified sampling was used to select study participants. Multivariable logistic regression was conducted to explore the associations between access to mass media and teenage pregnancy among adolescents in Zambia. All our analyses were done using SPSS version 25.

Results Out of 3000 adolescents, 897 (29.9%, 95% CI: 28.1-31.3) were pregnant or had ever been pregnant. Majority of the adolescents resided in rural areas (55.9%) and had a secondary education (53.6%). Adolescents who had exposure to internet, newspapers or magazines, radio and television were 10.5%, 22.6%, 43.1% and 43.1% respectively. Adolescents who had daily access to newspapers or magazines (AOR:0.33, 95% CI: 0.13-0.82) or using internet (AOR:0.55, 95% CI: 0.31-0.97) were less likely to be pregnant or to have had a pregnancy compared to those with no access to newspapers and internet respectively.

Conclusion Our study suggests that internet use and reading of newspapers or magazines may be an effective behavioral change approach to reduce teenage pregnancy. Behavioral change communicators can implement mass media campaigns using newspapers, magazines and the internet to publicise adolescent health messages and encourage adolescents to adopt healthy behaviours and prevent teenage pregnancies.
Strengths and limitations of the study

- This is the foremost nationwide analysis that explores the association between mass media exposure and teenage pregnancy.
- The study used a nationally representative sample using most recent Zambia Demographic and Health Survey (ZDHS) 2018 data, making the findings of the present study generalisable for Zambia female adolescents.
- The temporal relationship between the outcome variable and the independent variables could not be established due to the cross-sectional nature of the survey.
- ZDHS did not collect information on access to social media sites such as Facebook that can also impact sexual and reproductive health (SRH) information and behaviour as well the content of mass media that the adolescents were accessing.
Introduction

Globally, over 16 million girls aged 15 to 19 years give birth each year, contributing nearly 11% of all births worldwide. Over 90% of these births occur in low and middle-income countries and sub-Saharan Africa has the highest prevalence. Teenage pregnancies and childbirths are associated with negative maternal and perinatal health outcomes such as preterm delivery, low birth weight and death. Teenage pregnancy is further associated with social problems such as high school dropouts which prevents adolescents from achieving their full social and economic potential. Children born to adolescents are more likely to have lower school achievement and drop out of high school.

In low-and-middle-income countries (LMIC), limited access to SRH information, especially among adolescents undermines efforts to bring health care services closer to the people which further negatively affects progress towards universal health coverage. Mass media has been acknowledged globally as a cost-effective communication channel and it has been used successfully in various health programmes in low and middle income countries (LMIC). However, there is also some documented evidence of inconsistent outcomes with mass media campaigns, and some authors have argued that the effects observed are short term. To ensure effective adolescent health programming especially in a COVID era where use of mass media is highly recommended, there is need to examine the associations between different mass media channels and teenage pregnancy.

Furthermore, mass media is among the strategies used to promote utilisation of family planning through increased awareness, sensitization and debunking of false beliefs leading to a desired behavioral change. Irrespective of the global efforts employed in promoting interventions against teenage pregnancy such as uptake of family planning, the progress is slow. It is against this backdrop that this study examined the association between access to mass media and teenage pregnancy in Zambia. It also investigated the impacts of socio-economic variables on the relationship between access to mass media and teenage pregnancy using data from the 2018-2019 Zambia demographic and health survey (ZDHS). The findings will be crucial in identifying ways of improving the use of mass media and effectiveness of the socio-economic characteristics in reducing teenage pregnancies.
Methods

Data

Our study used the 2018-2019 Zambia Demographic and Health Survey (ZDHS) data to examine the association between mass media exposure and teenage pregnancy using a subsample of adolescents aged 15–19 years. The 2018 ZDHS data were collected between 18th July 2018 and 24th January 19. DHS are nationally representative household surveys that are periodically conducted using the cross-sectional design and widely used to monitor and evaluate population, health and nutrition indicators in low and middle income countries. The data used was collected using the women’s questionnaire in which information on individuals, household characteristics, nutrition and reproductive health history of women of reproductive age (15–49 years) was captured. Standardized sampling procedures are employed with a two-stage stratified method that resulted in the random selection of a representative sample of 13,625 households. The first stage involved 545 cluster (sample points) selection which consisted of enumeration areas using a sampling frame that was used during the 2010 census of population and housing (CPH). Enumeration areas were selected with a probability proportional to their size within each sampling stratum with the second stage having household selection using systematic sampling. Our secondary analysis included only adolescents aged 15 to 19 years. A total of 13,683 women aged 15-49 years in the sampled households who consented to participate in the survey were interviewed. Of the 13,683 women, 10,683 were aged 20-49 years hence our secondary analysis included a weighted sample of 3,000 adolescents aged 15-19 years. Written informed consent was provided by all participants of the survey. Written permission to access the whole ZDHS database was obtained through DHS program website.

Variables

Outcome variable

The outcome variable was teenage pregnancy that included adolescents who were currently pregnant or had an abortion or had given birth in the last five years preceding the survey and coded as one (1) and zero (0) for those who had never had a pregnancy.
Exposures
Adolescents were asked whether they use the internet (yes or no), own a mobile phone (yes or no), read a newspaper or magazine, listen to radio or watch television (TV) (almost every day, at least once a week, less than once a week or not at all).

Covariates
We included determinants of teenage pregnancy basing on available literature and data. Ten variables were considered and of these, two were community level factors that included; place of residence (rural and urban), and the ten provinces of Zambia. Three household level factors included; household size (less than six and six and above), sex of household head (male and female), and wealth index that was categorized into quintiles that ranged from the poorest to the richest quintile. Five individual level factors that included; age (15, 16, 17, 18 and 19), working status (yes and no), marital status (married and not married), education level (no education, primary, secondary and tertiary) and engaging in risky sexual behaviour (yes and no).

Adolescents were considered to have engaged in ‘risky sexual behavior’ if they reported to have engaged in sex with more than one partner or had transactional sex or had inconsistent condom use or had alcohol consumption at last sexual intercourse or had sexual intercourse before age 16.

Data analysis
We used SPSS version 25.0 statistical software and conducted the analysis using the complex sample function to account for the multi-stage cluster study design. Proportions and frequencies were tabulated for all the independent variables. To assess the association of each independent variable with teenage pregnancy, bivariable logistic regression was conducted and we presented crude odds ratio (COR), 95% confidence interval (CI) and p-values. Multivariable logistic regression was conducted with mass media and other sociodemographic independent variables that were found significant at bivariable level (p-value < 0.25). Adjusted odds ratios (AOR), 95% Confidence Intervals (CI) and p-values were calculated with statistical significance level set at p-value < 0.05. All variables in the model were assessed for collinearity, which was considered present if the variables had a variance inflation factor (VIF) greater than 10. To ensure validity of our study findings, sampling weights provided by UDHS were used.

Patient and public involvement
Patients were not involved. However, local authorities in the different provinces were contacted before data collection. A comprehensive report on the survey results was released and openly available on the DHS website.

Ethics approval

High international ethical standards are ensured for MEASURE DHS surveys as ethical approval from the country is obtained from a national ethical review board and local authorities before implementing the survey and well-informed verbal consent is sought from the respondents prior to data collection. For the 2018 ZDHS, ethical approval was obtained from the Inner City Fund (ICF) and the Zambia Tropical Diseases Research Centre (TDRC), institutional review boards (IRBs). All methods of data collection were performed in accordance with the relevant guidelines and regulations and all participants gave informed consent before participating in the survey. However, ethical approval ID was not provided in the ZDHS survey report.

Results

Sociodemographic characteristics of study population

Out of 3000 adolescents, 897 (29.9% 95% CI: 28.1-31.3) were pregnant or had ever been pregnant. The mean age of adolescents was 17.0 (standard deviation (SD) 1.4) years with majority (80.8%) of them having no exposure to internet (89.5%), newspapers (77.4%), radio (56.9%) or TV (56.9%). Majority of the adolescents resided in rural areas (55.9%), were not working (82.6%), not married (85.4%), had secondary education (53.6%), and were aged between 15 to 17 years (57.8%). More detailed characteristics of study participants are shown in Table 1.

Associations between access to mass media and teenage pregnancy

Results from multivariable logistic regression (Table 2) showed that exposure to newspapers or magazines, internet use, engaging in risky sexual behaviour, age, wealth quintiles, marital status and residence were positively associated with teenage pregnancy. Adolescents who had daily exposure to newspapers or magazines, using internet, aged 18-19 years, residing in urban areas, married, belonging to the poorest wealth quintile and engaging in risky sexual behaviour were 67% and 45% less likely to be pregnant or have had a pregnancy.
compared to those with no exposure to newspapers and internet respectively. Adolescents aged 18-19 years, residing in urban areas, married, belonging to the poorest wealth quintile and engaging in risky sexual behaviour were, 225%, 63%, 1182%, 552% and 2655% more likely to be pregnant or have had a pregnancy respectively compared to aged 15-17, in rural areas, not married, in the wealthiest quintile and not engaging in risky sexual behaviour respectively.

**Discussion**

This study assessed the association between exposure to mass media and teenage pregnancy in Zambia. The prevalence of teenage pregnancy in Zambia was 29.9% (95% CI: 28.1-31.3) similar to that of studies conducted in Sudan (31%), Ethiopia, (28.6%), and Turkey (29%) \(^{2,28,29}\). However, our study found a higher prevalence compared to the overall pooled prevalence of adolescent pregnancy in Africa (18.8%), East Africa (21.5%), and Latin America (6.4%) as shown by a systematic review by Kassa et al. \(^{30}\). The differences in accessibility of modern contraceptives, societal attitude towards the adolescent contraceptive use and knowledge of adolescents of the SRH issues could possibly explain the observed higher prevalence in Zambia. In Zambia, adolescent contraceptive services and SRH is only available in selected health facilities that offer youth friendly corner service \(^{31,32}\).

Contraceptive service being offered in the general reproductive health department is not tailored to adolescent needs hence they feel stigmatised and out of place leading to low utilisation \(^{31,32}\). Countries in East Africa such as Kenya have increased funding of policies and interventions towards contraceptives access and availability \(^{33,34}\). Rwanda’s small population size and the large population density made it easier for the government to ensure easier and faster implementation of family planning programs which lead to decreased prevalence of teenage pregnancy \(^{6,33,35}\). Furthermore, countries in Latin America and Asia have a higher gender equality compared to Zambia which makes women empowered to make positive decisions regarding contraceptive use and other SRH rights. However, our finding is lower than that in the Democratic Republic of the Congo and Central Africa Republic \(^{23}\). This could be partly attributed to the fact that Congo has one of the highest rates of child marriage globally \(^{23}\). Internet use was associated with less likelihood of teenage pregnancy. It is a popular observation that parents in most African communities rarely communicate about reproductive health with their children hence, adolescents tend to rely on informal sources for information about their
sexuality. Furthermore, traditional sexual education in Zambia deprive women of any bargaining power and hence the use of condom, sex frequency and practices are decided by the male partner. Different internet resources such as web pages, social media platforms, bulletin boards, and chatrooms may contain health information and provide access to information for a potentially large number of adolescents. Internet enables adolescents to have a high degree of interactivity, offers an anonymous, confidential and easily accessible space to find sensitive information about their sexuality. Internet enables adolescents to explore sensitive topics online which they may not want to reveal to other people. Besides being a source of health information that aids in sexual health promotion, contraceptive literacy and individual adolescent counseling via Web chat, internet can as well be used to purchase contraceptives.

Since most health programmes use mainstream mass media, the content of these mainstream media can be improved and become available on various social media platforms such as Facebook and on different websites by those using the internet. Social media platform access by adolescents is on the rise and we recommend further studies to look at the effect of social media platforms on teenage pregnancy. Adolescents who had almost daily access to newspapers or magazines were less likely to have had a teenage pregnancy compared to those without any access to newspapers or magazines. Newspapers or magazines are usually printed in many languages which enables a wide readership represent a time-honored means of disseminating printed information. They can contribute maximally to adolescent health education by publishing articles on diverse issues. This exposure enables adolescents to have greater access to sexual and reproductive health (SRH) information which empowers them and enables them to make positive SRH decisions and also become aware of availability of the different SRH services including family planning. Studies have documented that exposure to mass media is associated with increased utilisation of modern contraceptives as mass media is likely to lead to exposure to family planning messages capable of challenging negative attitudes to contraceptives.

The observed association between watching TV and listening to radio with teenage pregnancy at bivariable analysis level was lost when socio-economic variables were included during multivariable analysis. This indicates that socio-economic variables have an influence on teenage pregnancy by affecting how these mass media messages are received or accessed, utilised and
interpreted by respondents. This finding is in agreement with other studies conducted in similar contexts. Lim et al. showed that mainstream media such as TV and radio were the least comfort source of SRH for adolescents and internet was the most comfortable source. The non-significance observed with watching TV and listening to radio could be partly attributed to; media messages not addressing cultural and practical barriers to behaviour change, limited involvement of adolescent peers and role models who can easily influence the adolescents as they easily relate to them and limited engagement of local people or communities to ensure context specific and epidemiologically appropriate SRH messages. Furthermore, the SRH information provided by radio and TVs may increase awareness and sensitisation but fail to motivate adolescents to behavioral change hence the need to focus on behavioural change in the communities.

However, as much as exposure to media has been suggested to be effective in disseminating SRH information, some studies have shown increased engagement in risky sexual behaviour depending on the content being broadcasted hence the need to regulate internet and mass media use. Different studies examined the effects of mass media on adolescent sexual behavior have shown that exposure to media has influences on their sexual behavior which could be positive or negative depending on the content and in some contexts non-significant. To ensure effective use of mass media campaigns and that correct SRH information is passed on, we suggest that information professionals and other adolescent health practitioners should promote and prioritise pro-health internet sites addressing different adolescent health needs as a health information resource. However, there is need for guided internet access when adolescents use it.

**Strengths and limitations**

This is the foremost nationwide analysis that explores the association between mass media exposure and teenage pregnancy. Therefore, it can be used as a yardstick and motivation for further studies on related subject matter in order to ensure effective reduction in teenage pregnancies. Secondly, we used the most current nationally representative data hence the findings are generalisable to all adolescents in Zambia. However, use of cross-sectional data only enables the establishment of associations but not causal relationships and the self-reported answers risked the possibility of recall bias. ZDHS did not collect information on access to social
media sites such as Facebook that can also impact SRH information and behaviour. Lastly, the dataset did not include information about the content of mass media that the adolescents were accessing.

**Conclusion and public health implications**

A third of adolescents in Zambia were or had been pregnant at the time of the survey which shows that teenage pregnancy is more prevalent in Zambia compared to the African and Sub-Saharan average of 19%. Decreased exposure to newspapers or magazines and internet use were significantly associated with increased odds of teenage pregnancy. However, as much as exposure to media has been shown to be effective in disseminating SRH information, some studies have shown increased engagement in risky sexual behaviour depending on the content being broadcasted hence the need the regulate internet and mass media use. To ensure effective use of mass media campaigns and that correct SRH information is passed on, we would like to recommend the need for SRH workers to be highly involved in the production of campaign materials and to have internet use control measures. Further research is needed to understand the effects of other mass media such as social media on adolescent pregnancy.

Socio-economic variables such as older age, engaging in risky sexual behaviour, low wealth index, marriage and urban residence were significantly associated with teenage pregnancy. Findings show that factors are multidimensional, as they are related to the individual adolescents, household and the community which are beyond the control of adolescents. Multi-sectoral activities across sectors that encourage delayed marriage, contraceptive use, discourage risky sexual behaviour and empower households financially to reduce household poverty with urban areas being more targeted are essential. The Zambian government and the different stakeholders need to ensure that efforts are made to accommodate married and pregnant girls in schools. Additionally, the use of qualitative research can provide a better understanding of the complexities of adolescent pregnancy. Since the study participants were already pregnant during the survey, we recommend cohort studies that can further inform policy regarding casual relationships between access to mass media and teenage pregnancy. These studies can be designed to include social media platforms in addition to the traditional mass media.
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Contributors QS was the principal investigator on the project, conceptualised the study, designed the analysis, conducted the analysis and wrote the first draft of the paper. AAS was involved reviewing the study design, the results and drafting the article. DM was involved in data analysis, presentation and interpretation of the results. DM was involved in reviewing and interpreting the results, and reviewing the manuscript. All the authors reviewed and approved the manuscript. All the authors take responsibility for their contributions.

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Competing interests None declared.

Patient and public involvement Patients were not involved. However, local authorities in the different provinces were contacted before data collection. A comprehensive report on the survey results was released and openly available on the DHS website.

Patient consent for publication Not required.

Data availability statement All data are available from the Demographic and Health Surveys website (URL: https://www.dhsprogram.com/data/available-datasets.cfm) upon registration.

Ethics approval High international ethical standards are ensured for MEASURE DHS surveys as ethical approval from the country is obtained from a national ethical review board and local authorities before implementing the survey and well-informed verbal consent is sought from the respondents prior to data collection 19. For the 2018 ZDHS, ethical approval was obtained from the Inner City Fund (ICF) and the Zambia Tropical Diseases Research Centre (TDRC), institutional review boards (IRBs) 19. All methods of data collection were performed in accordance with the relevant guidelines and regulations and all participants gave informed consent before participating in the survey. However, ethical approval ID was not provided in the ZDHS survey report.

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### Table 1: Background characteristics of adolescents as per 2018 Zambia demographic health survey

| Characteristics          | N=3000 | Percent (%) |
|--------------------------|--------|-------------|
| **Teenage pregnancy**    |        |             |
| Yes                      | 897    | 29.9        |
| No                       | 2103   | 70.1        |
| **Mobile phone use**     |        |             |
| Yes                      | 944    | 31.5        |
| No                       | 2056   | 68.5        |
| **Listening to radio**   |        |             |
| Almost every day         | 386    | 12.9        |
| At least once a week     | 499    | 16.6        |
| Less than once a week    | 409    | 13.6        |
| Not at all               | 1707   | 56.9        |
| **Reading newspaper**    |        |             |
| Almost every day         | 100    | 3.3         |
| At least once a week     | 274    | 9.1         |
| Less than once a week    | 303    | 10.1        |
| Not at all               | 2323   | 77.4        |
| **Watching TV**          |        |             |
| Almost every day         | 808    | 26.9        |
| At least once a week     | 296    | 9.9         |
| Less than once a week    | 190    | 6.3         |
| Not at all               | 1706   | 56.9        |
| **Internet use**         |        |             |
| Yes                      | 316    | 10.5        |
| No                       | 2684   | 89.5        |
| **Household size**       |        |             |
| 6 and above              | 2017   | 67.2        |
| Less than 6              | 983    | 32.8        |
| **Residence**            |        |             |
| Urban                    | 1323   | 44.1        |
| Rural                    | 1677   | 55.9        |
| **Provinces**            |        |             |
| Location         | Count | Percentage |
|------------------|-------|------------|
| Central          | 297   | 9.9        |
| Copper belt      | 491   | 16.4       |
| Eastern          | 342   | 11.4       |
| Luapula          | 253   | 8.4        |
| Lusaka           | 475   | 15.8       |
| Muchinga         | 191   | 6.4        |
| Northern         | 248   | 8.3        |
| North Western    | 186   | 6.2        |
| Southern         | 327   | 10.9       |
| Western          | 190   | 6.3        |

**Working status**

| Status  | Count | Percentage |
|---------|-------|------------|
| Not working | 2477 | 82.6       |
| Working     | 523   | 17.4       |

**Marital status**

| Status   | Count | Percentage |
|----------|-------|------------|
| Not Married | 2563 | 85.4       |
| Married    | 437   | 14.6       |

**Education Level**

| Level      | Count | Percentage |
|------------|-------|------------|
| Higher     | 9     | 0.3        |
| Secondary  | 1609  | 53.6       |
| Primary Education | 1283 | 42.8       |
| No Education | 99   | 3.3        |

**Wealth Index**

| Index      | Count | Percentage |
|------------|-------|------------|
| Richest    | 709   | 23.6       |
| Richer     | 655   | 21.8       |
| Middle     | 585   | 19.5       |
| Poorer     | 541   | 18.0       |
| Poorest    | 510   | 17.0       |

**Age**

| Range     | Count | Percentage |
|-----------|-------|------------|
| 15-17     | 1735  | 57.8       |
| 18-19     | 1265  | 42.2       |

**Sex of Household Head**

| Sex       | Count | Percentage |
|-----------|-------|------------|
| Male      | 2166  | 72.2       |
| Female    | 834   | 27.8       |

**Risky sexual behavior**

| Status    | Count | Percentage |
|-----------|-------|------------|
| No        | 1647  | 54.9       |
| Yes       | 1353  | 45.1       |
Table 2: Associations between media exposure and teenage pregnancy among adolescents in Zambia as per ZDHS 2018

| Characteristics          | Teenage pregnancy n=897 | Univariable OR (95%CI) | P-value | Adjusted Model AOR (95% CI) |
|--------------------------|-------------------------|------------------------|---------|-----------------------------|
| Mobile phone use         |                         |                        |         |                             |
| No                       | 626 (69.8)              | 1                      | 1       |                             |
| Yes                      | 271 (30.2)              | 0.92(0.74-1.15)        | 0.473   | 1.05 (0.70-1.58)            |
| Listening to radio       |                         |                        | <0.001  |                             |
| Not at all               | 583 (65.0)              | 1                      | 1       |                             |
| Less than once a week    | 97 (10.8)               | **0.60(0.45-0.80)**    | **<0.001** | **0.79(0.51-1.23)**        |
| Atleast once a week      | 116 (12.9)              | **0.59(0.44-0.78)**    | **<0.001** | **0.75(0.47-1.19)**        |
| Almost every day         | 101 (11.3)              | **0.68(0.50-0.94)**    | **<0.001** | **0.81(0.48-1.37)**        |
| Reading newspaper        |                         |                        |         |                             |
| Not at all               | 776 (86.5)              | 1                      |         |                             |
| Less than once a week    | 69 (7.7)                | **0.58(0.38-0.89)**    | **<0.001** | **0.99(0.59-1.70)**        |
| Atleast once a week      | 45 (5.0)                | **0.40(0.27-0.59)**    |          | **0.75(0.44-1.27)**        |
| Almost every day         | 7 (0.8)                 | **0.15(0.07-0.31)**    |          | **0.33(0.13-0.82)**        |
| Watching TV              |                         |                        |         |                             |
| Not at all               | 671 (74.8)              | 1                      |         |                             |
| Less than once a week    | 55 (6.1)                | **0.64(0.44-0.93)**    | **<0.001** | **1.21(0.59-2.49)**        |
| Atleast once a week      | 62 (6.9)                | **0.41(0.25-0.68)**    |          | **0.91(0.49-1.71)**        |
| Almost every day         | 109 (12.2)              | **0.24(0.17-0.35)**    |          | **1.15(0.56-2.36)**        |
| Internet use             |                         |                        |         |                             |
| No                       | 860 (95.9)              | 1                      | **<0.001** | 1                          |
| Yes                      | 37 (4.1)                | **0.28(0.19-0.42)**    |          | **0.54(0.30-0.97)**        |
| Age                      |                         |                        | **<0.001** |                             |
| 15-17                    | 296 (33.0)              | 1                      |         |                             |
| 18-19                    | 601 (67.0)              | **4.40(3.62-5.36)**    | **<0.001** | **3.23(2.45-4.27)**        |
| Residence                |                         |                        |         |                             |
| Rural                    | 637 (71.0)              | 1                      |         |                             |
| Urban                    | 260 (29.0)              | **0.40(0.30-0.53)**    | **<0.001** | **1.63(1.06-2.49)**        |
| Marital status           |                         |                        |         |                             |
| Not Married              | 502 (56.0)              | 1                      |         |                             |
| Married                  | 395 (44.0)              | **37.93(26.72-53.85)** | **<0.001** | **12.84(8.02-20.56)**      |
| Wealth Index |   |   |   |<0.001 |
|--------------|---|---|---|--------|
| Richest      | 54 (6.0) | 1 |   | 1      |
| Richer       | 178 (19.8) | 4.51 (2.82-7.23) | 2.23 (1.16-4.28) |
| Middle       | 215 (24.0) | 7.05 (4.59-10.82) | 4.01 (1.84-8.76) |
| Poorer       | 211 (23.5) | 7.75 (5.06-11.86) | 4.43 (1.92-10.20) |
| Poorest      | 239 (26.6) | 10.74 (6.99-16.50) | 6.57 (2.69-16.05) |
| **Risky sexual behavior** |   |<0.001 |   |        |
| No           | 61 (6.8) | 1 |   | 1      |
| Yes          | 836 (93.2) | 42.30 (30.87-57.98) | 27.44 (20.44-37.83) |
| **Sex of household head** |   |<0.028 |   |        |
| Male         | 676 (75.4) | 1 |   | 1      |
| Female       | 221 (24.6) | 0.79 (0.65-0.98) | 1.03 (0.76-1.40) |
| **Provinces** |   |<0.001 |   |        |
| Western      | 82 (9.1) | 1 |   | 1      |
| Southern     | 142 (15.8) | 1.02 (0.62-1.67) | 1.69 (0.85-3.35) |
| North Western| 67 (7.5) | 0.73 (0.49-1.09) | 0.70 (0.42-1.17) |
| Northern     | 66 (7.4) | 0.47 (0.32-0.70) | 0.67 (0.32-1.40) |
| Muchinga     | 56 (6.2) | 0.55 (0.36-0.84) | 0.76 (0.38-1.54) |
| Lusaka       | 71 (7.9) | 0.23 (0.14-0.38) | 0.83 (0.41-1.67) |
| Luapula      | 77 (8.6) | 0.58 (0.39-0.85) | 0.83 (0.49-1.42) |
| Eastern      | 138 (15.4) | 0.89 (0.61-1.28) | 0.99 (0.58-1.69) |
| Copperbelt   | 104 (11.6) | 0.35 (0.23-0.53) | 1.71 (0.93-3.14) |
| Central      | 94 (10.5) | 0.61 (0.42-0.88) | 1.16 (0.68-2.00) |
| **Working status** |   |<0.001 |   |        |
| Not working  | 632 (70.5) | 1 |   | 1      |
| Working      | 264 (29.5) | 2.98 (2.44-3.66) | 1.41 (0.98-2.02) |
| **Education Level** |   |<0.001 |   |        |
| Higher       | 2 (0.2) | 1 |   | 1      |
| Secondary    | 378 (42.1) | 1.23 (0.19-7.80) | 1.01 (0.21-4.90) |
| Primary Education | 476 (53.1) | 2.35 (0.37-15.01) | 0.89 (0.18-4.51) |
| No Education | 41 (4.6) | 2.88 (0.44-19.04) | 0.61 (0.10-3.60) |
| **Household size** |   |<0.001 |   |        |
| Six and above | 518 (57.7) | 1 |   | 1      |
| Less than 6  | 379 (42.3) | 1.82 (1.44-2.28) | 0.71 (0.50-1.01) |

**Bold** significant at p-value less than 0.05
STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

| Item No | Recommendation                                                                 | Page No |
|---------|-----------------------------------------------------------------------------|---------|
|   1     | (a) Indicate the study’s design with a commonly used term in the title or the abstract | 1       |
|         | (b) Provide in the abstract an informative and balanced summary of what was done and what was found | 2       |
|   2     | Explain the scientific background and rationale for the investigation being reported | 4       |
|   3     | State specific objectives, including any prespecified hypotheses               | 4       |
|   4     | Present key elements of study design early in the paper                       | 5       |
|   5     | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5       |
|   6     | (a) Give the eligibility criteria, and the sources and methods of selection of participants | 5       |
|   7     | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5,6     |
|   8     | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 6       |
|   9     | Describe any efforts to address potential sources of bias                     | 6       |
|   10    | Explain how the study size was arrived at                                     | 5       |
|   11    | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 6,7     |
|   12    | (a) Describe all statistical methods, including those used to control for confounding | 6       |
|         | (b) Describe any methods used to examine subgroups and interactions           | 6       |
|         | (c) Explain how missing data were addressed                                  | NA      |
|         | (d) If applicable, describe analytical methods taking account of sampling strategy | 6       |
|         | (e) Describe any sensitivity analyses                                         | NA      |
|   13*   | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 5       |
|         | (b) Give reasons for non-participation at each stage                          | 5       |
|         | (c) Consider use of a flow diagram                                           | NA      |
|   14*   | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 7, 16-17|
|         | (b) Indicate number of participants with missing data for each variable of interest | NA      |
|   15*   | Report numbers of outcome events or summary measures                          | 7       |
|   16    | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 18-19   |
(b) Report category boundaries when continuous variables were categorized

(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | NA |
|----------------|----|-------------------------------------------------------------------------------------------------|-----|
| **Discussion** |    |                                                                                                 |    |
| Key results    | 18 | Summarise key results with reference to study objectives                                           | 8  |
| Limitations    | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 10-11 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 8-10 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results                             | 10 |
| **Other information** |     |                                                                                                  |    |
| Funding        | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | NA |

*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.
## Access to mass media and teenage pregnancy among adolescents in Zambia: a national cross-sectional survey

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Access to mass media and teenage pregnancy among adolescents in Zambia: a national cross-sectional survey

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Abstract

Objective: Teenage pregnancies and childbirths are associated with negative health outcomes. Access to health information enables adolescents to make appropriate decisions. However, the relationship between access to health information through mass media and teenage pregnancy has not received much attention in existing literature. We therefore examined the association between access to mass media and teenage pregnancy in Zambia.

Setting: Weighted data from the latest Zambian Demographic and Health Survey (ZDHS).

Participants: Weighted sample of 3000 adolescents aged 15-19 years

Primary and secondary outcome measure: Teenage pregnancy that included adolescents who were currently pregnant or had had an abortion or had given birth in the last five years preceding the survey (primary) and predictors of teenage pregnancy (secondary).

Results: Out of 3000 adolescents, 897 (29.9%, 95% CI: 28.1-31.3) were pregnant or had ever been pregnant. Majority of the adolescents resided in rural areas (55.9%) and had a secondary education (53.6%). Adolescents who had exposure to internet, newspapers or magazines, radio and television were 10.5%, 22.6%, 43.1% and 43.1% respectively. Adolescents who had daily access to newspapers or magazines (AOR:0.33, 95% CI: 0.13-0.82) or using internet (AOR:0.54, 95% CI: 0.30-0.95) were less likely to be pregnant or to have had a pregnancy compared to those with no access to newspapers and internet respectively.

Conclusion: Our study suggests that internet use and reading of newspapers or magazines may trigger behavioral change as an effective approach to reducing teenage pregnancy. Behavioral change communicators can implement mass media campaigns using newspapers, magazines and
the internet to publicise adolescent health messages that can encourage adolescents to adopt healthy behaviours and prevent teenage pregnancies.

**Strengths and limitations of the study**

- This is the foremost nationwide analysis that explores the association between mass media exposure and teenage pregnancy.
- The study used a sub-sample of adolescents from the latest nationally representative sample, making the findings generalisable for Zambian female adolescents.
- The temporal relationship between the outcome variable and the independent variables could not be established due to the cross-sectional nature of the survey.
- ZDHS did not collect information on what social media sites and content of information were accessed by those using internet.

**Introduction**

Globally, over 16 million girls aged 15 to 19 years give birth each year, contributing nearly 11% of all births worldwide. At least 90% of these births occur in low and middle-income countries and sub-Saharan Africa has among the highest prevalence of teenage pregnancy globally. Teenage pregnancies and childbirths are associated with negative maternal and perinatal health outcomes such as preterm delivery, low birth weight and death. Teenage pregnancy is further associated with social problems such as school dropouts which prevents the affected teenagers from achieving their full social and economic potential. Children born to adolescents are more likely to have lower school achievement and drop out of high school.

In low-and-middle-income countries (LMIC), limited access to sexual and reproductive health information, especially among adolescents undermines efforts to bring health care services closer
to the people which further negatively affects progress towards universal health coverage\textsuperscript{9,10}.

Although Zambia has registered an increase in the use of mass media among the young population through initiatives such as information communication technology (ICT) clubs in schools and the integration of ICTs into the education curriculum\textsuperscript{11}, there are still challenges of low access. Only 24.4\% and 3.8\% of women in urban and rural areas respectively reported ever using internet and 46\% of all women have no weekly access to the three traditional mass media channels (radio, television and newspapers)\textsuperscript{12}.

Mass media has been acknowledged globally as a cost-effective communication channel\textsuperscript{9,13} and it has been used successfully in various health programmes in low and middle income countries (LMIC)\textsuperscript{9,10,14-16}. However, there is also some documented evidence of inconsistent outcomes of mass media campaigns\textsuperscript{9,17} and some authors have argued that the effects observed are short term\textsuperscript{18,10,19}. Furthermore, mass media is among the strategies used to promote utilisation of family planning through increased awareness, sensitization and debunking of myths leading to a desired behavioral change\textsuperscript{20}. Lou et al. analysed data from three Asian countries and reported that access to and use of mass media has an influence on sexual intercourse-related knowledge, attitudes, and behaviors of adolescents and young adults\textsuperscript{21}. Although the association between mass media exposure and teenage pregnancy has not been studied in Zambia, some studies have examined the association of mass media and sexual reproductive health among the youth. Using demographic health survey (DHS) data of three countries (Kenya, Nigeria, and Zambia), Somefun et al. analysed influence of media exposure on human immunodeficiency virus (HIV) testing among the youth and documented a positive association between exposure to mass media and HIV testing\textsuperscript{22}. Van Rossem et al. also analysed data from Zambia Demographic and Health Survey (ZDHS) 2002 and reported that exposure to family planning and HIV radio and television
programmes was associated with higher odds of using condoms for both men and women. Worku et al. analysed East African countries’ DHS data to assess prevalence and associated factors of teenage pregnancy in the region and further documented exposure to mass media to be associated with less odds of teenage pregnancy. However, Worku et al. did not focus on mass media as main exposure but combined mass media as one variable making it impossible to examine the association of the different mass media with teenage pregnancy.

Despite the global efforts employed in promoting interventions against teenage pregnancy such as uptake of family planning, the progress is slow. In Zambia, 13% and 2.2% of adolescents have sexual intercourse and are married before age 15 respectively. The low contraceptive prevalence rate in this age group, puts Zambian adolescents at an increased risk of teenage pregnancies. Given the documented increase in the use of mass media among the young Zambians, we aimed to examine the association between access to mass media and teenage pregnancy in Zambia. The study also examined the association between other socio-economic variables and access to mass media and teenage pregnancy using data from the 2018-2019 Zambia demographic and health survey (ZDHS). The findings will be crucial in identifying ways of reducing teenage pregnancies by increasing mass media exposure and the effectiveness of other socio-economic characteristics.

Methods

Data

The 2018-2019 ZDHS data were used to examine the association between mass media exposure and teenage pregnancy using a subsample of adolescents aged 15–19 years. The 2018-2019
ZDHS data were collected between 18th July 2018 and 24th January 2019. The ZDHS are nationally representative and are conducted every five years to monitor and evaluate population, health and nutrition indicators in low and middle income countries. The data used for this study were collected using the women’s questionnaire in which information on individuals, household characteristics, nutrition and reproductive health history of women of reproductive age (15–49 years) was captured. Standardized sampling procedures are employed with a two-stage stratified method that resulted in the random selection of a representative sample of 13,625 households. “The first stage involved 545 cluster (sample points) selection which consisted of enumeration areas (EAs) using a sampling frame that was used during the 2010 census of population and housing (CPH)”.

The EAs in the first stage were selected with a probability proportional to their size within each sampling stratum with the second stage having household selection using systematic sampling. Our secondary analysis included only adolescents aged 15 to 19 years. A total of 13,683 women aged 15-49 years in the sampled households who consented to participate in the survey were interviewed. Of the 13,683 women, 10,683 were aged 20-49 years hence our secondary analysis included a weighted sample of 3,000 adolescents aged 15-19 years. A detailed description of the sampling process can be obtained in the 2018-2019 ZDHS report at the DHS program website.

Variables

Outcome variable

The outcome variable was teenage pregnancy that included adolescents who were currently pregnant or had an abortion or had given birth in the last five years preceding the survey and coded as one (1) and zero (0) for those who had never had a pregnancy.
Exposures

Adolescents were asked whether they use the internet (yes or no), own a mobile phone (yes or no), read a newspaper or magazine, listen to radio or watch television (TV) (almost every day, at least once a week, less than once a week or not at all).

Covariates

We included determinants of teenage pregnancy basing on available literature and data\textsuperscript{27-29}. Eleven variables were considered and of these, two were community level factors that included; place of residence (rural and urban), and the ten provinces of Zambia. Three household level factors included; household size (less than six and six and above), sex of household head (male and female), and wealth index that was categorized into quintiles that ranged from the poorest to the richest quintile. Six individual level factors that included; age (15 to 17 and 18 to 19), working status (yes and no), marital status (married including those legally and not legally married but living with their partnerships and not married including those divorced, separated and widowed), education level (no education, primary and post-primary (tertiary only had two adolescents so it was combined with secondary), knowledge of any modern contraceptive (yes and no) and engaging in risky sexual behaviour (yes and no). Adolescents were considered to have engaged in ‘risky sexual behaviour’ if they reported to have engaged in sex with more than one partner or had transactional sex or had inconsistent condom use or had alcohol consumption at last sexual intercourse or had sexual intercourse before age 16\textsuperscript{30-32}.

Data analysis

Analysis was conducted using SPSS version 25.0 statistical software’s complex sample function in order to account for the multi-stage cluster study design. Proportions and frequencies were
tabulated for all the independent variables. To assess the association of each independent variable with teenage pregnancy, bivariable logistic regression was conducted and we presented crude odds ratio (COR), 95% confidence interval (CI) and p-values. Multivariable logistic regression was conducted with mass media and other sociodemographic independent variables with a p-value < 0.25 at bivariable level. Adjusted odds ratios (AOR), 95% CI and p-values were calculated with statistical significance level set at p-value < 0.05. All variables in the model were assessed for collinearity, which was considered present if the variables had a variance inflation factor (VIF) greater than 5. To ensure validity of our study findings, sampling weights provided by ZDHS were used. **Supplementary file 1 shows the STROBE checklist.**

**Patient and public involvement**

The ZDHS did not involve patients. However, before data collection, the different provincial local authorities were contacted, and their permission sought. The results of the 2018-2019 ZDHS are openly available to the public on the DHS website (https://www.dhsprogram.com/).

**Ethics approval**

The 2018-2019 ZDHS protocol was reviewed and approved by the Inner City Fund (ICF) and the Zambia Tropical Diseases Research Centre (TDRC), institutional review boards (IRBs)\(^\text{12}\). The team ensured that all field activities followed the relevant national and international guidelines and regulations including informed consent. However, ethical approval ID was not provided in the ZDHS survey report.

**Results**

**Sociodemographic characteristics of study population**
Out of 3000 adolescents, 897 (29.9% 95% CI: 28.1-31.3) were pregnant or had ever been pregnant. The mean age of adolescents was 17.0 (standard deviation (SD) 1.4) years. Majority of the adolescents resided in rural areas (55.9%), were not working (82.6%), not married (85.4%), had post-primary education (53.9%), and were aged between 15 to 17 years (57.8%). More detailed characteristics of study participants are shown in Table 1.

Mass media use

Majority of the adolescents have no exposure to internet (89.5%), newspapers (77.5%), radio (56.9%) or TV (56.9%). Exposure to newspapers/magazines was the lowest at 22.5% of which only 3.3% had exposure almost every day. Although exposure to radio and television both are at 43.1%, being exposed to television almost every day is at 26.9% compared to 12.9% for being exposed to radio almost every day.

Associations between access to mass media and teenage pregnancy

Results from multivariable logistic regression (Table 2) showed that exposure to newspapers or magazines and internet use were significantly associated with teenage pregnancy. Adolescents who had daily exposure to newspapers or magazines (AOR: 0.33, 95% CI: 0.13-0.82), using internet (AOR: 0.54, 95% CI: 0.30-0.95), had less odds of being pregnant or have had a pregnancy compared to those with no exposure to newspapers and internet respectively. Other socio-economic variables such as engaging in risky sexual behaviour, age, wealth quintiles, marital status, knowledge of modern contraceptives and residence were significantly associated with teenage pregnancy. Adolescents without knowledge of any modern contraceptive
(AOR: 0.26, 95% CI: 0.08-0.80) had less odds of being pregnant or have had a pregnancy compared to those with knowledge of any modern contraceptive. Adolescents aged 18-19 years (AOR: 3.22, 95% CI: 2.44-4.25), residing in urban areas (AOR: 1.64, 95% CI: 1.07-2.50), married (AOR: 12.67, 95% CI: 7.90-20.30), belonging to the poorest wealth quintile (AOR: 6.70, 95% CI: 2.76-16.24), and engaging in risky sexual behaviour (AOR: 26.31, 95% CI: 19.58-35.36) were associated with higher odds of being pregnant or have had a pregnancy compared to those aged 15-17, in rural areas, not married, in the wealthiest quintile and not engaging in risky sexual behaviour respectively.

Discussion

This study assessed the association between exposure to mass media and teenage pregnancy in Zambia. Majority of the adolescents have no exposure to internet (89.5%), newspapers (77.5%), radio (56.9%) or TV (56.9%). The prevalence of teenage pregnancy in Zambia was 29.9% (95% CI: 28.1-31.3) similar to that of studies conducted in Sudan (31%), Ethiopia, (28.6%), and Turkey (29%) \(^2,33,34\). However, our study found a higher prevalence compared to the overall pooled prevalence of adolescent pregnancy in Africa (18.8%), East Africa (21.5%), and Latin America (6.4%) as shown by a systematic review by Kassa et al. \(^35\). The differences in accessibility of modern contraceptives, societal attitude towards the adolescent contraceptive use and knowledge of adolescents of the SRH issues could possibly explain the observed higher prevalence in Zambia. Among the mass media variables, exposure to newspapers/magazines and internet were the significant ones and these were associated with less odds of teenage pregnancy.
Internet use was associated with less likelihood of teenage pregnancy. It is a popular observation that parents in most African communities rarely communicate about reproductive health with their children hence, adolescents tend to rely on informal sources for information about their sexuality. Furthermore, traditional sexual education in Zambia deprive women of any bargaining power and hence the use of condom, frequency of sexual intercourse and practices are decided by the male partner. Different internet resources such as web pages, social media platforms, bulletin boards, and chatrooms may contain health information and provide access to information for a potentially large number of adolescents. Internet enables adolescents to have a high degree of interactivity, offers an anonymous, confidential and easily accessible space to find sensitive information about their sexuality. Internet enables adolescents to explore sensitive topics online while ensuring their privacy is protected. Besides being a source of health information that aids in sexual health promotion, contraceptive literacy and individual adolescent counseling via Web chat, internet can as well be used to purchase contraceptives.

Since most health programmes use mainstream mass media, the content of these mainstream media can be improved and be made available on various social media platforms such as Facebook and on different websites by those using the internet. Social media platform access by adolescents is on the rise and we recommend further studies to look at the effect of social media platforms on teenage pregnancy. Adolescents who had almost daily access to newspapers or magazines were less likely to have had a teenage pregnancy compared to those without any access to newspapers or magazines. Newspapers or magazines are usually printed in many languages which enables a wide readership represent a time-honored means of disseminating printed information. They can contribute maximally to adolescent health education by publishing articles on diverse issues. This exposure enables adolescents to have greater access...
to sexual and reproductive health (SRH) information which empowers them and enables them to make positive SRH decisions and also become aware of availability of the different SRH services including family planning. The culture of reading is not particularly common in many African communities. There is, therefore, the possibility that adolescents who read newspapers and magazines are academically inclined or focused on their studies. Such adolescents would rarely indulge in risky sexual behaviours. Studies have documented that exposure to mass media is associated with increased utilisation of modern contraceptives as mass media is likely to lead to exposure to family planning messages capable of challenging negative attitudes to contraceptives.

The observed association between watching TV and listening to radio with teenage pregnancy at bivariable analysis level was lost when socio-economic variables were included during multivariable analysis. This indicates that socio-economic variables have an influence on teenage pregnancy by affecting how these mass media messages are received or accessed, utilised and interpreted by respondents. This finding is in agreement with other studies conducted in similar contexts. Lim et al. showed that mainstream media such as TV and radio were the least comfort source of SRH (information?) for adolescents and internet was the most comfortable source. The non-significance observed with watching TV and listening to radio could be partly attributed to; media messages not addressing cultural and practical barriers to behaviour change, limited involvement of adolescent peers and role models who can easily influence the adolescents as they easily relate to them and limited engagement of local people or communities to ensure context specific and epidemiologically appropriate SRH messages. Furthermore, the SRH information provided by radio and TVs may increase awareness and sensitisation but fail to
motivate adolescents to behavioral change hence the need to focus on behavioural change in the communities 19.

However, as much as exposure to media has been suggested to be effective in disseminating SRH information, some studies have shown increased engagement in risky sexual behaviour depending on the content being broadcasted hence the need to regulate internet and mass media use 28, 48. Different studies examined the effects of mass media on adolescent sexual behavior have shown that exposure to media has influences on their sexual behavior which could be positive or negative depending on the content 1, 49, 50 and in some contexts, non-significant 19. Mercy et al. analysed association between social media and teenage Pregnancy among secondary school Students in Kenya and documented high access to social networking sites and this contributed to increased teenage pregnancy prevalence since most of the students accessed sexually explicit content and less of directed academic information 51. Chandra et al. further showed that without control of content, accessing sexual content on television was associated with higher odds of teenage pregnancy which finding was similar to that of Lin et al. in Taiwan with mass media exposure increasing the odds of risky sexual behaviour 52. To ensure effective use of mass media campaigns and that appropriate SRH information is passed on, we suggest that information dissemination professionals and other adolescent health practitioners should promote and prioritise pro-health internet sites addressing different adolescent health needs as a health information resource. However, there is need for guided internet access when adolescents use it.

Strengths and limitations
This is the foremost nationwide analysis that explores the association between mass media exposure and teenage pregnancy. Therefore, it can be used as a yardstick and motivation for further studies on related subject matter in order to ensure effective reduction in teenage pregnancies. Secondly, we used a sub-sample from the most current nationally representative data hence the findings are generalisable to all adolescents in Zambia. However, use of cross-sectional data only enables the establishment of associations but not causal relationships and the self-reported answers risked the possibility of recall bias. Besides providing information on use of internet, ZDHS did not collect information on what specific social media sites or content were accessed by those using internet which information would be crucial to analyse. Lastly, the dataset did not include information about the content of mass media that the adolescents were accessing.

Conclusion

A third of adolescents in Zambia were or had been pregnant at the time of the survey which shows that teenage pregnancy is more prevalent in Zambia compared to the African and Sub-Saharan average of 19%. Exposure to newspapers or magazines and internet use were associated with less odds of teenage pregnancy. To ensure effective use of mass media campaigns and that correct SRH information is passed on, we would like to recommend the need for SRH workers to be highly involved in the production of SRH mass media content, encourage and support provision of newspapers/magazines containing SRH sections to adolescents in schools/adolescent health units in health centres and to subsidise internet access costs as a way of increasing access. Further research is needed to understand the effects of other mass media such as social media on adolescent pregnancy.
Socio-economic variables such as older age, engaging in risky sexual behaviour, low wealth index, marriage, knowledge on modern contraceptives and urban residence were significantly associated with teenage pregnancy. Findings show that factors are multidimensional, as they are related to the individual adolescents, household and the community which are beyond the control of adolescents. Multi-sectoral activities across sectors that encourage delayed marriage, contraceptive use, discourage risky sexual behaviour and empower households financially to reduce household poverty with urban areas being more targeted are essential. The Zambian government and the different stakeholders need to ensure that efforts are made to accommodate married and pregnant girls in schools. Having knowledge of any contraceptive method was associated with more odds of teenage pregnancy which could be due to inadequate knowledge, barriers in accessing and using contraceptives, including stigma and discrimination by contraceptive providers hence the need to strengthen the quality of contraceptive counselling, increase access to adolescent friendly health units that can enable adolescents easily access contraceptives. Additionally, the use of qualitative research can provide a better understanding of the complexities of adolescent pregnancy. Since the study participants were already pregnant during the survey, we recommend cohort studies that can further inform policy regarding casual relationships between access to mass media and teenage pregnancy. These studies can be designed to include social media platforms in addition to the traditional mass media.

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**Competing interests** None declared.

**Patient and public involvement** The ZDHS did not involve patients. However, before data collection, the different provincial local authorities were contacted and their permission sought. The results of the survey are openly available on the DHS website in a summarised report.

**Patient consent for publication** Not required.

**Data availability statement** All data are available from the Demographic and Health Surveys website (URL: https://www.dhsprogram.com/data/available-datasets.cfm) upon registration.

**Ethics approval.** The 2018-2019 ZDHS protocol was reviewed and approved by the Inner City Fund (ICF) and the Zambia Tropical Diseases Research Centre (TDRC), institutional review boards (IRBs)\(^{12}\). The team ensured that all field activities followed the relevant national and international guidelines and regulations including informed consent. However, ethical approval ID was not provided in the ZDHS survey report.

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**Table 1: Background characteristics of adolescents as per 2018 Zambia demographic health survey**

| Characteristics            | N=3000 | Percent (%) |
|----------------------------|--------|-------------|
| **Teenage pregnancy**      |        |             |
| Yes                        | 897    | 29.9        |
| No                         | 2103   | 70.1        |
| **Mobile phone use**       |        |             |
| Yes                        | 944    | 31.5        |
| No                         | 2056   | 68.5        |
| **Listening to radio**     |        |             |
| Almost every day           | 386    | 12.9        |
| At least once a week       | 499    | 16.6        |
| Less than once a week      | 409    | 13.6        |
| Not at all                 | 1707   | 56.9        |
| **Reading newspaper**      |        |             |
| Almost every day           | 100    | 3.3         |
| At least once a week       | 274    | 9.1         |
|             | Count | Percentage |
|-------------|-------|------------|
| **Watching TV** |       |            |
| Almost every day | 808   | 26.9       |
| At least once a week | 296   | 9.9        |
| Less than once a week | 190   | 6.3        |
| Not at all | 1706  | 56.9       |
| **Internet use** |       |            |
| Yes | 316   | 10.5       |
| No | 2684  | 89.5       |
| **Household size** |       |            |
| 6 and above | 2017  | 67.2       |
| Less than 6 | 983   | 32.8       |
| **Residence** |       |            |
| Urban | 1323  | 44.1       |
| Rural | 1677  | 55.9       |
| **Provinces** |       |            |
| Central | 297   | 9.9        |
| Copper belt | 491   | 16.4       |
| Eastern | 342   | 11.4       |
| Luapula | 253   | 8.4        |
| Lusaka | 475   | 15.8       |
| Muchinga | 191   | 6.4        |
| Northern | 248   | 8.3        |
| North Western | 186   | 6.2        |
| Southern | 327   | 10.9       |
| Western | 190   | 6.3        |
| **Working status** |       |            |
| Not working | 2477  | 82.6       |
| Working | 523   | 17.4       |
| **Marital status** |       |            |
| Not Married | 2563  | 85.4       |
| Married | 437   | 14.6       |
| **Education Level** |       |            |
| Secondary | 1618  | 53.9       |
| Primary Education | 1283  | 42.8       |
| No Education | 99    | 3.3        |
| **Wealth Index** |       |            |
| Richest | 709   | 23.6       |
| Richer | 655   | 21.8       |
| Middle | 585   | 19.5       |
| Poorer | 541   | 18.0       |
| Poorest | 510   | 17.0       |
| **Age** |       |            |
| 15-17 | 1735  | 57.8       |
Table 2: Associations between media exposure and teenage pregnancy among adolescents in Zambia as per ZDHS 2018

| Characteristics                  | Teenage pregnancy n=897 | Univariable OR (95%CI) | P-value | Adjusted Model AOR (95% CI) |
|----------------------------------|-------------------------|------------------------|---------|-----------------------------|
| Mobile phone use                 |                         |                        |         |                             |
| No                               | 626 (69.8)              | 1                      | 0.173   |                             |
| Yes                              | 271 (30.2)              | 0.92 (0.74-1.15)       |         | 1.05 (0.70-1.57)            |
| Listening to radio               |                         |                        |         |                             |
| Not at all                       | 583 (65.0)              | 1                      | <0.001  | 1                           |
| Less than once a week            | 97 (10.8)               | 0.60 (0.45-0.80)       |         | 0.78 (0.51-1.20)            |
| Atleast once a week              | 116 (12.9)              | 0.59 (0.44-0.78)       |         | 0.75 (0.47-1.18)            |
| Almost every day                 | 101 (11.3)              | 0.68 (0.50-0.94)       |         | 0.80 (0.48-1.35)            |
| Reading newspaper                |                         |                        |         |                             |
| Not at all                       | 776 (86.5)              | 1                      | <0.001  | 1                           |
| Less than once a week            | 69 (7.7)                | 0.58 (0.38-0.89)       |         | 0.98 (0.57-1.67)            |
| Atleast once a week              | 45 (5.0)                | 0.40 (0.27-0.59)       |         | 0.73 (0.43-1.25)            |
| Almost every day                 | 7 (0.8)                 | 0.15 (0.07-0.31)       |         | 0.33 (0.13-0.82)            |
| Watching TV                      |                         |                        | <0.001  |                             |
| Not at all                       | 671 (74.8)              | 1                      |         | 1                           |
| Less than once a week            | 55 (6.1)                | 0.64 (0.44-0.93)       |         | 1.19 (0.58-2.44)            |
| Atleast once a week              | 62 (6.9)                | 0.41 (0.25-0.68)       |         | 0.90 (0.48-1.68)            |
| Almost every day                 | 109 (12.2)              | 0.24 (0.17-0.35)       |         | 1.13 (0.55-2.31)            |
| Internet use                     |                         |                        |         |                             |
| No                               | 860 (95.9)              | 1                      | <0.001  | 1                           |
| Yes                              | 37 (4.1)                | 0.28(0.19-0.42)        |         | 0.54 (0.30-0.95)            |
| Age                              |                         |                        | <0.001  |                             |

Sex of Household Head
- Male: 2166 (72.2)
- Female: 834 (27.8)

Risky sexual behavior
- No: 1647 (54.9)
- Yes: 1353 (45.1)

Knowledge of any modern contraceptive
- Yes: 2845 (94.8)
- No: 155 (5.2)
### Residence

| Group   | Count | 95% CI |  \( p \)-value |
|---------|-------|--------|-----------------|
| Rural   | 637 (71.0) | 4.40 (3.62-5.36) | <0.001 |
| Urban   | 260 (29.0) | 0.40 (0.30-0.53) | 1.64 (1.07-2.50) | <0.001 |

### Marital status

| Group     | Count | 95% CI |  \( p \)-value |
|-----------|-------|--------|----------------|
| Not Married | 502 (56.0) | 37.93 (26.72-53.85) | 12.67 (7.90-20.30) | <0.001 |
| Married   | 395 (44.0) | 7.75 (5.06-11.86) | 4.54 (1.99-10.39) | <0.001 |

### Wealth Index

| Group   | Count | 95% CI |  \( p \)-value |
|---------|-------|--------|----------------|
| Richest | 54 (6.0) | 4.51 (2.82-7.23) | 2.27 (1.19-4.33) | <0.001 |
| Richer  | 178 (19.8) | 7.05 (4.59-10.82) | 4.03 (1.86-8.75) | <0.001 |
| Middle  | 215 (24.0) | 7.75 (5.06-11.86) | 4.54 (1.99-10.39) | <0.001 |
| Poorer  | 211 (23.5) | 10.74 (6.99-16.50) | 6.70 (2.76-16.24) | <0.001 |
| Poorest | 239 (26.6) | 10.74 (6.99-16.50) | 6.70 (2.76-16.24) | <0.001 |

### Risky sexual behavior

| Group   | Count | 95% CI |  \( p \)-value |
|---------|-------|--------|----------------|
| No      | 61 (6.8) | 0.79 (0.65-0.98) | 1.03 (0.76-1.41) | <0.001 |
| Yes     | 836 (93.2) | 42.30 (30.87-57.98) | 26.31 (19.58-35.36) | <0.001 |

### Sex of household head

| Group   | Count | 95% CI |  \( p \)-value |
|---------|-------|--------|----------------|
| Male    | 676 (75.4) | 0.79 (0.65-0.98) | 1.03 (0.76-1.41) | 0.028 |
| Female  | 221 (24.6) | 2.35 (1.48-3.74) | 0.74 (0.32-1.71) | <0.001 |

### Provinces

| Province | Count | 95% CI |  \( p \)-value |
|----------|-------|--------|----------------|
| Western  | 82 (9.1) | 1.02 (0.62-1.67) | 1.67 (0.85-3.29) | 0.028 |
| Southern | 142 (15.8) | 0.73 (0.49-1.09) | 0.67 (0.40-1.12) | <0.001 |
| North Western | 67 (7.5) | 0.47 (0.32-0.70) | 0.67 (0.32-1.41) | <0.001 |
| North | 66 (7.4) | 0.55 (0.36-0.84) | 0.72 (0.36-1.45) | 0.028 |
| Muchinga | 56 (6.2) | 0.23 (0.14-0.38) | 0.86 (0.42-1.76) | <0.001 |
| Luanshya | 71 (7.9) | 0.58 (0.39-0.85) | 0.81 (0.48-1.38) | <0.001 |
| Luapula | 77 (8.6) | 0.58 (0.39-0.85) | 0.81 (0.48-1.38) | <0.001 |
| Eastern | 138 (15.4) | 0.89 (0.61-1.28) | 0.96 (0.56-1.64) | <0.001 |
| Copperbelt | 104 (11.6) | 0.35 (0.23-0.53) | 1.66 (0.90-3.06) | <0.001 |
| Central | 94 (10.5) | 0.61 (0.42-0.88) | 1.16 (0.68-1.98) | <0.001 |

### Working status

| Status    | Count | 95% CI |  \( p \)-value |
|-----------|-------|--------|----------------|
| Not working | 632 (70.5) | 2.98 (2.44-3.66) | 1.39 (0.97-1.99) | <0.001 |
| Working | 265 (29.5) | 0.23 (0.14-0.38) | 0.86 (0.42-1.76) | <0.001 |

### Education Level

| Level        | Count | 95% CI |  \( p \)-value |
|--------------|-------|--------|----------------|
| Post-Primary | 380 (42.3) | 1.92 (1.54-2.40) | 0.90 (0.63-1.28) | <0.001 |
| Primary Education | 476 (53.1) | 2.35 (1.48-3.74) | 0.74 (0.32-1.71) | <0.001 |
| No Education | 41 (4.6) | 1.82 (1.44-2.28) | 0.71 (0.50-1.01) | <0.001 |

### Household size

| Size        | Count | 95% CI |  \( p \)-value |
|-------------|-------|--------|----------------|
| Six and above | 518 (57.7) | 0.17 (0.08-0.36) | 0.26 (0.08-0.80) | <0.001 |
| Less than 6 | 379 (42.3) | 0.17 (0.08-0.36) | 0.26 (0.08-0.80) | <0.001 |

### Knowledge of any modern contraception

| Status   | Count | 95% CI |  \( p \)-value |
|----------|-------|--------|----------------|
| Yes      | 886 (98.8) | 0.17 (0.08-0.36) | 0.26 (0.08-0.80) | <0.001 |
| No       | 11 (1.2) | 0.17 (0.08-0.36) | 0.26 (0.08-0.80) | <0.001 |
Bold significant at p-value less than 0.05
# STROBE Statement—Checklist of items that should be included in reports of cross-sectional studies

| Item No | Recommendation | Page No |
|---------|----------------|---------|
| **Title and abstract** | | |
| 1 | (a) Indicate the study’s design with a commonly used term in the title or the abstract | 1 |
| 2 | (b) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | |
| 2 | Explain the scientific background and rationale for the investigation being reported | 3-5 |
| **Objectives** | | |
| 3 | State specific objectives, including any prespecified hypotheses | 5 |
| **Methods** | | |
| 4 | Present key elements of study design early in the paper | 6 |
| 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 6 |
| 6 | (a) Give the eligibility criteria, and the sources and methods of selection of participants | 5-6 |
| 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 6,7 |
| 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 7 |
| 9 | Describe any efforts to address potential sources of bias | 8 |
| 10 | Explain how the study size was arrived at | 6 |
| 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 7,8 |
| **Statistical methods** | | |
| 12 | (a) Describe all statistical methods, including those used to control for confounding | 8 |
| | (b) Describe any methods used to examine subgroups and interactions | 8 |
| | (c) Explain how missing data were addressed | NA |
| | (d) If applicable, describe analytical methods taking account of sampling strategy | 7,8 |
| | (g) Describe any sensitivity analyses | NA |
| **Results** | | |
| 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 6 |
| | (b) Give reasons for non-participation at each stage | 6 |
| | (c) Consider use of a flow diagram | NA |
| 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 8-9 |
| | (b) Indicate number of participants with missing data for each variable of interest | NA |
| **Outcome data** | | |
| 15* | Report numbers of outcome events or summary measures | 8 |
| **Main results** | | |
| 16 | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 9-10 |
(b) Report category boundaries when continuous variables were categorized

(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | NA |

**Discussion**

| Key results | 18 | Summarise key results with reference to study objectives | 10 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 14 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 10-14 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 14 |

**Other information**

| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | NA |

*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).
Access to mass media and teenage pregnancy among adolescents in Zambia: a national cross-sectional survey

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| Keywords: | Epidemiology < TROPICAL MEDICINE, MEDICAL JOURNALISM, PUBLIC HEALTH |
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Access to mass media and teenage pregnancy among adolescents in Zambia: a national cross-sectional survey

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Abstract

Objective: Teenage pregnancies and childbirths are associated with negative health outcomes. Access to health information enables adolescents to make appropriate decisions. However, the relationship between access to health information through mass media and teenage pregnancy has not received much attention in existing literature. We therefore examined the association between access to mass media and teenage pregnancy in Zambia.

Design: Cross-sectional

Setting: Zambia.

Participants: Weighted sample of 3000 adolescents aged 15-19 years

Outcome measure: Teenage pregnancy that included adolescents who were currently pregnant or had had an abortion or had given birth in the last five years preceding the survey.

Results: Out of 3000 adolescents, 897 (29.9%, 95% CI: 28.1-31.3) were pregnant or had ever been pregnant. Majority of the adolescents resided in rural areas (55.9%) and had a secondary education (53.6%). Adolescents who had exposure to internet, newspapers or magazines, radio and television were 10.5%, 22.6%, 43.1% and 43.1% respectively. Adolescents who had daily access to newspapers or magazines (AOR:0.33, 95% CI: 0.13-0.82) or using internet (AOR:0.54, 95% CI: 0.30-0.95) were less likely to be pregnant or to have had a pregnancy compared to those with no access to newspapers and internet respectively.

Conclusion: Our study suggests that internet use and reading of newspapers or magazines may trigger behavioral change as an effective approach to reducing teenage pregnancy. Behavioral change communicators can implement mass media campaigns using newspapers, magazines and
the internet to publicise adolescent health messages that can encourage adolescents to adopt healthy behaviours and prevent teenage pregnancies.

**Strengths and limitations of the study**

- This is the foremost nationwide analysis that explores the association between mass media exposure and teenage pregnancy.
- The study used a sub-sample of adolescents from the latest nationally representative sample, making the findings generalisable for Zambian female adolescents.
- The temporal relationship between the outcome variable and the independent variables could not be established due to the cross-sectional nature of the survey.
- ZDHS did not collect information on what social media sites and content of information were accessed by those using internet.

**Introduction**

Globally, over 16 million girls aged 15 to 19 years give birth each year, contributing nearly 11% of all births worldwide. At least 90% of these births occur in low and middle-income countries and sub-Saharan Africa has among the highest prevalence of teenage pregnancy globally. Teenage pregnancies and childbirths are associated with negative maternal and perinatal health outcomes such as preterm delivery, low birth weight and death. Teenage pregnancy is further associated with social problems such as school dropouts which prevents the affected teenagers from achieving their full social and economic potential. Children born to adolescents are more likely to have lower school achievement and drop out of high school.

In low-and-middle-income countries (LMIC), limited access to sexual and reproductive health information, especially among adolescents undermines efforts to bring health care services closer
to the people which further negatively affects progress towards universal health coverage 9-11.

Although Zambia has registered an increase in the use of mass media among the young population through initiatives such as information communication technology (ICT) clubs in schools and the integration of ICTs into the education curriculum 12, there are still challenges of low access. Only 24.4% and 3.8% of women in urban and rural areas respectively reported ever using internet and 46% of all women have no weekly access to the three traditional mass media channels (radio, television and newspapers) 13.

Mass media has been acknowledged globally as a cost-effective communication channel 9, 14 and it has been used successfully in various health programmes in low and middle income countries (LMIC) 9, 10, 15-18. However, there is also some documented evidence of inconsistent outcomes of mass media campaigns, 9, 19 and some authors have argued that the effects observed are short term 20 10, 21. Furthermore, mass media is among the strategies used to promote utilisation of family planning through increased awareness, sensitization and debunking of myths leading to a desired behavioral change 22. Lou et al. analysed data from three Asian countries and reported that access to and use of mass media has an influence on sexual intercourse-related knowledge, attitudes, and behaviors of adolescents and young adults 23. Although the association between mass media exposure and teenage pregnancy has not been studied in Zambia, some studies have examined the association of mass media and sexual reproductive health among the youth. Using demographic health survey (DHS) data of three countries (Kenya, Nigeria, and Zambia), Somefun et al. analysed influence of media exposure on human immunodeficiency virus (HIV) testing among the youth and documented a positive association between exposure to mass media and HIV testing 24. Van Rossem et al. also analysed data from Zambia Demographic and Health Survey (ZDHS) 2002 and reported that exposure to family planning and HIV radio and television
programmes was associated with higher odds of using condoms for both men and women. Worku et al. analysed East African countries’ DHS data to assess prevalence and associated factors of teenage pregnancy in the region and further documented exposure to mass media to be associated with less odds of teenage pregnancy. However, Worku et al. did not focus on mass media as main exposure but combined mass media as one variable making it impossible to examine the association of the different mass media with teenage pregnancy.

Despite the global efforts employed in promoting interventions against teenage pregnancy such as uptake of family planning, the progress is slow. In Zambia, 13% and 2.2% of adolescents have sexual intercourse and are married before age 15 respectively. The low contraceptive prevalence rate in this age group, puts Zambian adolescents at an increased risk of teenage pregnancies. Given the documented increase in the use of mass media among the young Zambians, we aimed to examine the association between access to mass media and teenage pregnancy in Zambia. The study also examined the association between other socio-economic variables and access to mass media and teenage pregnancy using data from the 2018-2019 Zambia demographic and health survey (ZDHS). The findings will be crucial in identifying ways of reducing teenage pregnancies by increasing mass media exposure and the effectiveness of other socio-economic characteristics.

**Methods**

**Data**

The 2018-2019 ZDHS data were used to examine the association between mass media exposure and teenage pregnancy using a subsample of adolescents aged 15–19 years. The 2018-2019
ZDHS data were collected between 18th July 2018 and 24th January 2019. The ZDHS are nationally representative and conducted every five years to monitor and evaluate population, health and nutrition indicators in low and middle income countries. The data used for this study were collected using the women’s questionnaire in which information on individuals, household characteristics, nutrition and reproductive health history of women of reproductive age (15–49 years) was captured. Standardized sampling procedures are employed with a two-stage stratified method that resulted in the random selection of a representative sample of 13,625 households. “The first stage involved 545 cluster (sample points) selection which consisted of enumeration areas (EAs) using a sampling frame that was used during the 2010 census of population and housing (CPH)” The EAs in the first stage were selected with a probability proportional to their size within each sampling stratum with the second stage having household selection using systematic sampling. Our secondary analysis included only adolescents aged 15 to 19 years. A total of 13,683 women aged 15-49 years in the sampled households who consented to participate in the survey were interviewed. Of the 13,683 women, 10,683 were aged 20-49 years hence our secondary analysis included a weighted sample of 3,000 adolescents aged 15-19 years. A detailed description of the sampling process can be obtained in the 2018-2019 ZDHS report at the DHS program website.

Variables

Outcome variable

The outcome variable was teenage pregnancy that included adolescents who were currently pregnant or had an abortion or had given birth in the last five years preceding the survey and coded as one (1) and zero (0) for those who had never had a pregnancy.
Exposures

Adolescents were asked whether they use the internet (yes or no), own a mobile phone (yes or no), read a newspaper or magazine, listen to radio or watch television (TV) (almost every day, at least once a week, less than once a week or not at all).

Covariates

We included determinants of teenage pregnancy basing on available literature and data. Eleven variables were considered and of these, two were community level factors that included; place of residence (rural and urban), and the ten provinces of Zambia. Three household level factors included; household size (less than six and six and above), sex of household head (male and female), and wealth index that was categorized into quintiles that ranged from the poorest to the richest quintile. Six individual level factors that included; age (15 to 17 and 18 to 19), working status (yes and no), marital status (married including those legally and not legally married but living with their partnerships and not married including those divorced, separated and widowed), education level (no education, primary and post-primary (tertiary only had two adolescents so it was combined with secondary), knowledge of any modern contraceptive (yes and no) and engaging in risky sexual behaviour (yes and no). Adolescents were considered to have engaged in ‘risky sexual behavior’ if they reported to have engaged in sex with more than one partner or had transactional sex or had inconsistent condom use or had alcohol consumption at last sexual intercourse or had sexual intercourse before age 16.

Data analysis

Analysis was conducted using SPSS version 25.0 statistical software’s complex sample function in order to account for the multi-stage cluster study design. Proportions and frequencies were
tabulated for all the independent variables. To assess the association of each independent variable with teenage pregnancy, bivariable logistic regression was conducted and we presented crude odds ratio (COR), 95% confidence interval (CI) and p-values. Multivariable logistic regression was conducted with mass media and other sociodemographic independent variables with a p-value < 0.25 at bivariable level. Adjusted odds ratios (AOR), 95% CI and p-values were calculated with statistical significance level set at p-value < 0.05. All variables in the model were assessed for collinearity, which was considered present if the variables had a variance inflation factor (VIF) greater than 5. To ensure validity of our study findings, sampling weights provided by ZDHS were used. Supplementary file 1 shows the STROBE checklist.

Patient and public involvement

The ZDHS did not involve patients. However, before data collection, the different provincial local authorities were contacted, and their permission sought. The results of the 2018-2019 ZDHS are openly available to the public on the DHS website (https://www.dhsprogram.com/).

Ethics approval

The 2018-2019 ZDHS protocol was reviewed and approved by the Inner City Fund (ICF) and the Zambia Tropical Diseases Research Centre (TDRC), institutional review boards (IRBs). The team ensured that all field activities followed the relevant national and international guidelines and regulations including informed consent. However, ethical approval ID was not provided in the ZDHS survey report.

Results

Sociodemographic characteristics of study population
Out of 3000 adolescents, 897 (29.9% 95% CI: 28.1-31.3) were pregnant or had ever been pregnant. The mean age of adolescents was 17.0 (standard deviation (SD) 1.4) years. Majority of the adolescents resided in rural areas (55.9%), were not working (82.6%), not married (85.4%), had post-primary education (53.9%), and were aged between 15 to 17 years (57.8%). More detailed characteristics of study participants are shown in Table 1.

Mass media use

Majority of the adolescents have no exposure to internet (89.5%), newspapers (77.5%), radio (56.9%) or TV (56.9%). Exposure to newspapers/magazines was the lowest at 22.5% of which only 3.3% had exposure almost every day. Although exposure to radio and television both are at 43.1%, being exposed to television almost every day is at 26.9% compared to 12.9% for being exposed to radio almost every day.

Associations between access to mass media and teenage pregnancy

Results from multivariable logistic regression (Table 2) showed that exposure to newspapers or magazines and internet use were significantly associated with teenage pregnancy. Adolescents who had daily exposure to newspapers or magazines (AOR: 0.33, 95% CI: 0.13-0.82), using internet (AOR: 0.54, 95% CI: 0.30-0.95), had less odds of being pregnant or have had a pregnancy compared to those with no exposure to newspapers and internet respectively. Other socio-economic variables such as engaging in risky sexual behaviour, age, wealth quintiles, marital status, knowledge of modern contraceptives and residence were significantly associated with teenage pregnancy. Adolescents without knowledge of any modern contraceptive
(AOR: 0.26, 95% CI: 0.08-0.80) had less odds of being pregnant compared to those with knowledge of any modern contraceptive. Adolescents aged 18-19 years (AOR: 3.22, 95% CI: 2.44-4.25), residing in urban areas (AOR: 1.64, 95% CI: 1.07-2.50), married (AOR: 12.67, 95% CI: 7.90-20.30), belonging to the poorest wealth quintile (AOR: 6.70, 95% CI: 2.76-16.24), and engaging in risky sexual behaviour (AOR: 26.31, 95% CI: 19.58-35.36) were associated with higher odds of being pregnant or have had a pregnancy compared to those aged 15-17, in rural areas, not married, in the wealthiest quintile and not engaging in risky sexual behaviour respectively.

Discussion

This study assessed the association between exposure to mass media and teenage pregnancy in Zambia. Majority of the adolescents have no exposure to internet (89.5%), newspapers (77.5%), radio (56.9%) or TV (56.9%). The prevalence of teenage pregnancy in Zambia was 29.9% (95% CI: 28.1-31.3) similar to that of studies conducted in Sudan (31%), Ethiopia, (28.6%), and Turkey (29%)\(^2, 35, 36\). However, our study found a higher prevalence compared to the overall pooled prevalence of adolescent pregnancy in Africa (18.8%), East Africa (21.5%), and Latin America (6.4%) as shown by a systematic review by Kassa et al.\(^37\). The differences in accessibility of modern contraceptives, societal attitude towards the adolescent contraceptive use and knowledge of adolescents of the SRH issues could possibly explain the observed higher prevalence in Zambia. Among the mass media variables, exposure to newspapers/magazines and internet were the significant ones and these were associated with less odds of teenage pregnancy.
Internet use was associated with less likelihood of teenage pregnancy. It is a popular observation that parents in most African communities rarely communicate about reproductive health with their children hence, adolescents tend to rely on informal sources for information about their sexuality. Furthermore, traditional sexual education in Zambia deprive women of any bargaining power and hence the use of condom, frequency of sexual intercourse and practices are decided by the male partner. Different internet resources such as web pages, social media platforms, bulletin boards, and chatrooms may contain health information and provide access to information for a potentially large number of adolescents. Internet enables adolescents to have a high degree of interactivity, offers an anonymous, confidential and easily accessible space to find sensitive information about their sexuality. Internet enables adolescents to explore sensitive topics online while ensuring their privacy is protected. Besides being a source of health information that aids in sexual health promotion, contraceptive literacy and individual adolescent counseling via Web chat, internet can as well be used to purchase contraceptives.

Since most health programmes use mainstream mass media, the content of these mainstream media can be improved and be made available on various social media platforms such as Facebook and on different websites by those using the internet. Social media platform access by adolescents is on the rise and we recommend further studies to look at the effect of social media platforms on teenage pregnancy. Adolescents who had almost daily access to newspapers or magazines were less likely to have had a teenage pregnancy compared to those without any access to newspapers or magazines. Newspapers or magazines are usually printed in many languages which enables a wide readership represent a time-honored means of disseminating printed information. They can contribute maximally to adolescent health education by publishing articles on diverse issues. This exposure enables adolescents to have greater access
to sexual and reproductive health (SRH) information which empowers them and enables them to make positive SRH decisions and also become aware of availability of the different SRH services including family planning $^{30,46}$. The culture of reading is not particularly common in many African communities. There is, therefore, the possibility that adolescents who read newspapers and magazines are academically inclined or focused on their studies. Such adolescents would rarely indulge in risky sexual behaviours. Studies have documented that exposure to mass media is associated with increased utilisation of modern contraceptives $^{9,22,47,48}$ as mass media is likely to lead to exposure to family planning messages capable of challenging negative attitudes to contraceptives $^{47}$.

The observed association between watching TV and listening to radio with teenage pregnancy at bivariate analysis level was lost when socio-economic variables were included during multivariable analysis. This indicates that socio-economic variables have an influence on teenage pregnancy by affecting how these mass media messages are received or accessed, utilised and interpreted by respondents. This finding is in agreement with other studies conducted in similar contexts $^{22}$. Lim et al. showed that mainstream media such as TV and radio were the least comfort source of SRH information for adolescents and internet was the most comfortable source $^{49}$. The non-significance observed with watching TV and listening to radio could be partly attributed to; media messages not addressing cultural and practical barriers to behaviour change, limited involvement of adolescent peers and role models who can easily influence the adolescents as they easily relate to them and limited engagement of local people or communities to ensure context specific and epidemiologically appropriate SRH messages $^{9}$. Furthermore, the SRH information provided by radio and TVs may increase awareness and sensitization $^{18}$ but fail
to motivate adolescents to behavioral change hence the need to focus on behavioural change in
the communities 21.

However, as much as exposure to media has been suggested to be effective in disseminating
SRH information, some studies have shown increased engagement in risky sexual behaviour
depending on the content being broadcasted hence the need to regulate internet and mass media
use 30, 50. Different studies examined the effects of mass media on adolescent sexual behavior
have shown that exposure to media has influences on their sexual behavior which could be
positive or negative depending on the content 1, 51, 52 and in some contexts, non-significant 21.

Mercy et al. analysed association between social media and teenage Pregnancy among secondary
school Students in Kenya and documented high access to social networking sites and this
contributed to increased teenage pregnancy prevalence since most of the students accessed
sexually explicit content and less of directed academic information 53. Chandra et al. further
showed that without control of content, accessing sexual content on television was associated
with higher odds of teenage pregnancy which finding was similar to that of Lin et al. in Taiwan
with mass media exposure increasing the odds of risky sexual behaviour 54. To ensure effective
use of mass media campaigns and that appropriate SRH information is passed on, we suggest
that information dissemination professionals and other adolescent health practitioners should
promote and prioritise pro-health internet sites addressing different adolescent health needs as a
health information resource. However, there is need for guided internet access when adolescents
use it.

Strengths and limitations
This is the foremost nationwide analysis that explores the association between mass media exposure and teenage pregnancy. Therefore, it can be used as a yardstick and motivation for further studies on related subject matter in order to ensure effective reduction in teenage pregnancies. Secondly, we used a sub-sample from the most current nationally representative data hence the findings are generalisable to all adolescents in Zambia. However, use of cross-sectional data only enables the establishment of associations but not causal relationships and the self-reported answers risked the possibility of recall bias. Besides providing information on use of internet, ZDHS did not collect information on what specific social media sites or content were accessed by those using internet which information would be crucial to analyse. Lastly, the dataset did not include information about the content of mass media that the adolescents were accessing.

**Conclusion**

A third of adolescents in Zambia were or had been pregnant at the time of the survey which shows that teenage pregnancy is more prevalent in Zambia compared to the African and Sub-Saharan average of 19%. Exposure to newspapers or magazines and internet use were associated with less odds of teenage pregnancy. To ensure effective use of mass media campaigns and that correct SRH information is passed on, we would like to recommend the need for SRH workers to be highly involved in the production of SRH mass media content, encourage and support provision of newspapers/magazines containing SRH sections to adolescents in schools/adolescent health units in health centres and to subsidise internet access costs as a way of increasing access. Further research is needed to understand the effects of other mass media such as social media on adolescent pregnancy.
Socio-economic variables such as older age, engaging in risky sexual behaviour, low wealth index, marriage, knowledge on modern contraceptives and urban residence were significantly associated with teenage pregnancy. Findings show that factors are multidimensional, as they are related to the individual adolescents, household and the community which are beyond the control of adolescents. Multi-sectoral activities across sectors that encourage delayed marriage, contraceptive use, discourage risky sexual behaviour and empower households financially to reduce household poverty with urban areas being more targeted are essential. The Zambian government and the different stakeholders need to ensure that efforts are made to accommodate married and pregnant girls in schools. Having knowledge of any contraceptive method was associated with more odds of teenage pregnancy which could be due to inadequate knowledge, barriers in accessing and using contraceptives, including stigma and discrimination by contraceptive providers hence the need to strengthen the quality of contraceptive counselling, increase access to adolescent friendly health units that can enable adolescents easily access contraceptives. Additionally, the use of qualitative research can provide a better understanding of the complexities of adolescent pregnancy. Since the study participants were already pregnant during the survey, we recommend cohort studies that can further inform policy regarding casual relationships between access to mass media and teenage pregnancy. These studies can be designed to include social media platforms in addition to the traditional mass media.

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paper. AAS was involved reviewing the study design, the results and drafting the article. DM was involved in data analysis, presentation and interpretation of the results. DM was involved in reviewing and interpreting the results, and reviewing the manuscript. All the authors reviewed and approved the manuscript. All the authors take responsibility for their contributions.

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**Competing interests** None declared.

**Patient and public involvement** The ZDHS did not involve patients. However, before data collection, the different provincial local authorities were contacted and their permission sought. The results of the survey are openly available on the DHS website in a summarised report.

**Patient consent for publication** Not required.

**Data availability statement** All data are available from the Demographic and Health Surveys website (URL: https://www.dhsprogram.com/data/available-datasets.cfm) upon registration.

**Ethics approval.** The 2018-2019 ZDHS protocol was reviewed and approved by the Inner City Fund (ICF) and the Zambia Tropical Diseases Research Centre (TDRC), institutional review boards (IRBs)\textsuperscript{13}. The team ensured that all field activities followed the relevant national and international guidelines and regulations including informed consent. However, ethical approval ID was not provided in the ZDHS survey report.

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Table 1: Background characteristics of adolescents as per 2018 Zambia demographic health survey

| Characteristics            | N=3000 | Percent (%) |
|----------------------------|--------|-------------|
| **Teenage pregnancy**      |        |             |
| Yes                        | 897    | 29.9        |
| No                         | 2103   | 70.1        |
| **Mobile phone use**       |        |             |
| Yes                        | 944    | 31.5        |
| No                         | 2056   | 68.5        |
| **Listening to radio**     |        |             |
| Almost every day           | 386    | 12.9        |
| At least once a week       | 499    | 16.6        |
| Less than once a week      | 409    | 13.6        |
| Not at all                 | 1707   | 56.9        |
| **Reading newspaper**      |        |             |
| Almost every day           | 100    | 3.3         |
| At least once a week       | 274    | 9.1         |
| Less than once a week      | 303    | 10.1        |
| Not at all                 | 2323   | 77.5        |
| **Watching TV**            |        |             |
| Almost every day           | 808    | 26.9        |
| At least once a week       | 296    | 9.9         |
| Less than once a week      | 190    | 6.3         |
| Not at all                 | 1706   | 56.9        |
| **Internet use**           |        |             |

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|                       |         |       |
|-----------------------|---------|-------|
| **Yes**               | 316     | 10.5  |
| **No**                | 2684    | 89.5  |
| **Household size**    |         |       |
| 6 and above           | 2017    | 67.2  |
| Less than 6           | 983     | 32.8  |
| **Residence**         |         |       |
| Urban                 | 1323    | 44.1  |
| Rural                 | 1677    | 55.9  |
| **Provinces**         |         |       |
| Central               | 297     | 9.9   |
| Copper belt           | 491     | 16.4  |
| Eastern               | 342     | 11.4  |
| Luapula               | 253     | 8.4   |
| Lusaka                | 475     | 15.8  |
| Muchinga              | 191     | 6.4   |
| Northern              | 248     | 8.3   |
| North Western         | 186     | 6.2   |
| Southern              | 327     | 10.9  |
| Western               | 190     | 6.3   |
| **Working status**    |         |       |
| Not working           | 2477    | 82.6  |
| Working               | 523     | 17.4  |
| **Marital status**    |         |       |
| Not Married           | 2563    | 85.4  |
| Married               | 437     | 14.6  |
| **Education Level**   |         |       |
| Secondary             | 1618    | 53.9  |
| Primary Education     | 1283    | 42.8  |
| No Education          | 99      | 3.3   |
| **Wealth Index**      |         |       |
| Richest               | 709     | 23.6  |
| Richer                | 655     | 21.8  |
| Middle                | 585     | 19.5  |
| Poorer                | 541     | 18.0  |
| Poorest               | 510     | 17.0  |
| **Age**               |         |       |
| 15-17                 | 1735    | 57.8  |
| 18-19                 | 1265    | 42.2  |
| **Sex of Household Head** |     |       |
| Male                  | 2166    | 72.2  |
| Female                | 834     | 27.8  |
| **Risky sexual behavior** |     |       |
| No                    | 1647    | 54.9  |
| Yes                   | 1353    | 45.1  |
| Knowledge of any modern contraceptive | | |
| Characteristics                      | Teenage pregnancy n=897 | Univariable OR (95%CI) | P-value | Adjusted Model AOR (95% CI) |
|-------------------------------------|-------------------------|------------------------|---------|-----------------------------|
| Mobile phone use                    |                         |                        |         |                             |
| No                                 | 626 (69.8)              | 1                      | 0.173   | 1                           |
| Yes                                | 271 (30.2)              | 0.92(0.74-1.15)        |         | 1.05 (0.70-1.57)            |
| Listening to radio                 |                         |                        | <0.001  |                             |
| Not at all                          | 583 (65.0)              | 1                      |         | 1                           |
| Less than once a week               | 97 (10.8)               | 0.60(0.45-0.80)        |         | 0.78(0.51-1.20)             |
| At least once a week                | 116 (12.9)              | 0.59(0.44-0.78)        |         | 0.75(0.47-1.18)             |
| Almost every day                    | 101 (11.3)              | 0.68(0.50-0.94)        |         | 0.80(0.48-1.35)             |
| Reading newspaper                  |                         |                        |         |                             |
| Not at all                          | 776 (86.5)              | 1                      | <0.001  | 1                           |
| Less than once a week               | 69 (7.7)                | 0.58(0.38-0.89)        |         | 0.98(0.57-1.67)             |
| At least once a week                | 45 (5.0)                | 0.40(0.27-0.59)        |         | 0.73(0.43-1.25)             |
| Almost every day                    | 7 (0.8)                 | 0.15(0.07-0.31)        |         | 0.33(0.13-0.82)             |
| Watching TV                         |                         |                        | <0.001  |                             |
| Not at all                          | 671 (74.8)              | 1                      |         | 1                           |
| Less than once a week               | 55 (6.1)                | 0.64(0.44-0.93)        |         | 1.19(0.58-2.44)             |
| At least once a week                | 62 (6.9)                | 0.41(0.25-0.68)        |         | 0.90(0.48-1.68)             |
| Almost every day                    | 109 (12.2)              | 0.24(0.17-0.35)        |         | 1.13(0.55-2.31)             |
| Internet use                        |                         |                        |         |                             |
| No                                 | 860 (95.9)              | 1                      | <0.001  | 1                           |
| Yes                                | 37 (4.1)                | 0.28(0.19-0.42)        |         | 0.54(0.30-0.95)             |
| Age                                |                         |                        | <0.001  |                             |
| 15-17                               | 296 (33.0)              | 1                      |         | 1                           |
| 18-19                               | 601 (67.0)              | 4.40(3.62-5.36)        |         | 3.22(2.44-4.25)             |
| Residence                           |                         |                        | <0.001  |                             |
| Rural                               | 637 (71.0)              | 1                      |         | 1                           |
| Urban                               | 260 (29.0)              | 0.40(0.30-0.53)        |         | 1.64(1.07-2.50)             |
| Marital status                      |                         |                        | <0.001  |                             |
| Not Married                         | 502 (56.0)              | 1                      |         | 1                           |
| Married                             | 395 (44.0)              | 37.93(26.72-53.85)     |         | 12.67(7.90-20.30)           |
| Wealth Index       |        |
|--------------------|--------|
| Richest            | 54 (6.0) | <0.001 |
| Richer             | 178 (19.8) | 4.51 (2.82-7.23) | 2.27 (1.19-4.33) |
| Middle             | 215 (24.0) | 7.05 (4.59-10.82) | 4.03 (1.86-8.75) |
| Poorer             | 211 (23.5) | 7.75 (5.06-11.86) | 4.54 (1.99-10.39) |
| Poorest            | 239 (26.6) | 10.74 (6.99-16.50) | 6.70 (2.76-16.24) |

| Risky sexual behavior |        |
|-----------------------|--------|
| Yes                   | 836 (93.2) | 42.30 (30.87-57.98) | 26.31 (19.58-35.36) |

| Sex of household head |        |
|-----------------------|--------|
| Male                  | 676 (75.4) | 1 |
| Female                | 221 (24.6) | 0.79 (0.65-0.98) | 1.03 (0.76-1.41) |

| Provinces            |        |
|----------------------|--------|
| Western              | 82 (9.1) | 1 |
| Southern             | 142 (15.8) | 1.02 (0.62-1.67) | 1.67 (0.85-3.29) |
| North Western        | 67 (7.5) | 0.73 (0.49-1.09) | 0.67 (0.40-1.12) |
| Northern             | 66 (7.4) | 0.47 (0.32-0.70) | 0.67 (0.32-1.41) |
| Muchinga             | 56 (6.2) | 0.55 (0.36-0.84) | 0.72 (0.36-1.45) |
| Lusaka               | 71 (7.9) | 0.23 (0.14-0.38) | 0.86 (0.42-1.76) |
| Luapula              | 77 (8.6) | 0.58 (0.39-0.85) | 0.81 (0.48-1.38) |
| Eastern              | 138 (15.4) | 0.89 (0.61-1.28) | 0.96 (0.56-1.64) |
| Copperbelt           | 104 (11.6) | 0.35 (0.23-0.53) | 1.66 (0.90-3.06) |
| Central              | 94 (10.5) | 0.61 (0.42-0.88) | 1.16 (0.68-1.98) |

| Working status       |        |
|----------------------|--------|
| Not working          | 632 (70.5) | 1 |
| Working              | 265 (29.5) | 2.98 (2.44-3.66) | 1.39 (0.97-1.99) |

| Education Level      |        |
|----------------------|--------|
| Post-Primary         | 380 (42.3) | 1 |
| Primary Education    | 476 (53.1) | 1.92 (1.54-2.40) | 0.90 (0.63-1.28) |
| No Education         | 41 (4.6) | 2.35 (1.48-3.74) | 0.74 (0.32-1.71) |

| Household size       |        |
|----------------------|--------|
| Six and above        | 518 (57.7) | 1 |
| Less than 6          | 379 (42.3) | 1.82 (1.44-2.28) | 0.71 (0.50-1.01) |

| Knowledge of any modern contraception |        |
|---------------------------------------|--------|
| Yes                                   | 886 (98.8) | 1 |
| No                                    | 11 (1.2) | 0.17 (0.08-0.36) | 0.26 (0.08-0.80) |

**Bold** significant at p-value less than 0.05
# STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

| Item No | Recommendation | Page No |
|---------|----------------|---------|
| **Title and abstract** | 1  
(a) Indicate the study’s design with a commonly used term in the title or the abstract  
(b) Provide in the abstract an informative and balanced summary of what was done and what was found | 1, 2 |
| **Introduction** | 2  
Explain the scientific background and rationale for the investigation being reported | 3-5 |
| **Objectives** | 3  
State specific objectives, including any prespecified hypotheses | 5 |
| **Methods** | 4  
Present key elements of study design early in the paper | 6 |
| **Setting** | 5  
Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 6 |
| **Participants** | 6  
(a) Give the eligibility criteria, and the sources and methods of selection of participants | 5-6 |
| **Variables** | 7  
Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 6, 7 |
| **Data sources/measurement** | 8*  
For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 7 |
| **Bias** | 9  
Describe any efforts to address potential sources of bias | 8 |
| **Study size** | 10  
Explain how the study size was arrived at | 6 |
| **Quantitative variables** | 11  
Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 7, 8 |
| **Statistical methods** | 12  
(a) Describe all statistical methods, including those used to control for confounding  
(b) Describe any methods used to examine subgroups and interactions  
(c) Explain how missing data were addressed  
(d) If applicable, describe analytical methods taking account of sampling strategy  
(g) Describe any sensitivity analyses | 8, NA, NA, 7.8, NA |
| **Results** | 13*  
(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed  
(b) Give reasons for non-participation at each stage  
(c) Consider use of a flow diagram | 6, 6, NA |
| **Descriptive data** | 14*  
(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders  
(b) Indicate number of participants with missing data for each variable of interest | 8-9, NA |
| **Outcome data** | 15*  
Report numbers of outcome events or summary measures | 8 |
| **Main results** | 16  
(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 9-10 |
(b) Report category boundaries when continuous variables were categorized

(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

| Other analyses | 17 | Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses | NA |

**Discussion**

| Key results | 18 | Summarise key results with reference to study objectives | 10 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 14 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 10-14 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 14 |

**Other information**

| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | NA |

*Give information separately for exposed and unexposed groups.*

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).