



Research article

The relationship between accurate knowledge on HIV/AIDS transmission and adolescent pregnancy in Ghana: A further analyses of the 2017 multiple cluster indicator survey

Emmanuel Brenyah Adomako^a, Kwabena Frimpong-Manso^a, Petronella Munemo^b, Henry Ofori Duah^c, Pascal Agbadi^{d,*}^a Department of Social Work, University of Ghana, Legon, Ghana^b Institute of Statistical, Social and Economic Research, University of Ghana, Legon, Ghana^c Research Department, FOCOS Orthopaedic Hospital, Accra, Ghana^d Department of Nursing, College of Health Sciences, Kwame Nkrumah University of Science and Technology, PMB, Kumasi, Ghana

ARTICLE INFO

Keywords:
Adolescents
Pregnancy
HIV/AIDS
Transmission

ABSTRACT

Background: The literature posits that HIV knowledge is associated with precautionary sexual behaviour and practice. We hypothesised and investigated the association between knowledge of HIV transmission and adolescent pregnancy in Ghana, given that the relationship between HIV knowledge and adolescent pregnancy has not been extensively studied.

Methods: We did analyses on 5836 cases (weighted as 5121) of 15–24 years old reproductive age women in the female dataset of the 2017 Multiple Cluster Indicator Survey. Adolescent pregnancy was operationalized as reproductive age women between 15–24 years who became pregnant before the age of 18 years. Accurate HIV knowledge was measured by computing the scores of correct responses on six questions exploring women's knowledge about HIV transmission. We accounted for sample design and weight before performing a Chi-square test of independence and Poisson regression.

Results: The results indicate that having lower scores on the HIV transmission knowledge scale was correlated with a higher probability of girls becoming pregnant before their 18th birthday. After controlling for the moderating effect of socio-demographic characteristics of the participants, we found that accurate HIV transmission knowledge loses its statistical significance in determining adolescent pregnancy. The factors that remain significant in the adjusted model were formal education status, household wealth, and region of residence. HIV transmission knowledge was statistically significantly related to adolescent pregnancy in the model after the education level variable was omitted. This observation was due to the significant effect of school education on other variables in the model. This result demonstrates that HIV knowledge has a major impact on adolescent pregnancy, but this effect is predicated by formal education attainment of the adolescent girl.

Conclusions: Given the results, adolescent pregnancy issues can be resolved by the government and other development partners by adequately educating adolescents about HIV transmissions. Also, because they have the potential to reduce pregnancy among adolescents in Ghana, we recommend that programs and initiatives should address existing disparities in formal educational attainment and household wealth.

1. Introduction

Adolescent pregnancies are global population health problem given the number of adolescents who become pregnant in their teen years. Annually, twenty-one million adolescents become pregnant before their 18th birthday and about twelve million give birth in developing regions,

with many of these cases recorded in Eastern Asia and Western sub-Saharan Africa (Kassa et al., 2018; WHO, 2020). Becoming pregnant before eighteen years is one of the multiple life challenges that affect the growth, development, and future economic independence of adolescent girls globally (Pillay and Nesengani, 2006; Leese, 2016; Mangeli et al., 2017; Herrman and Nandakumar, 2012; Barmao-Kiptanui et al., 2015;

* Corresponding author.

E-mail address: pascalagbadi@gmail.com (P. Agbadi).

Vincent and Alemu, 2016). In sub-Saharan Africa, most of these adolescent pregnancies are often accompanied with complications when they attempt to abort or go through childbirth (Nove et al., 2014; WHO, 2016; Gronvik and Sandoy, 2018). These complications lead to severe disabilities, morbidities, and mortalities in the worst-case scenario (Ogelle et al., 2014; Wado et al., 2019). Adolescent girls often drop out of school because of pregnancy and childbirth, denying them access to education that will allow them to be economically independent and resilient to structural gender inequity and inequality, which is deeply entrenched in many societies in sub-Saharan Africa (Fatti et al., 2014).

Two out of ten adolescent girls in Ghana become pregnant or have their first child before 18 years (Ministry of Gender Children and Social Protection, 2017). Given the multiple socioeconomic ills and health complications suffered by pregnant adolescents, government and non-governmental organizations have made numerous efforts to address the issue of adolescent pregnancy. The National Population Council, for example, coordinated a conference in Accra in 1996 that brought together youth groups, ministries of government and non-governmental organisations to formulate a policy on adolescent reproductive health (National Population Council, 2000). The goal of the adolescent reproductive health policy was to enhance cooperation between ministries, NGO's, youth organisations and agencies involved in the creation and implementation of adolescent sexual reproductive health programmes (National Population Council, 2000). Besides, the 2001 National Adolescent Health and Development Initiative, the seven-year (2009–2015) National Strategic Plan for Adolescent Health Development and the Adolescent Health Care Policy and Strategy (2016–2020) were created to mitigate adolescent reproductive health concerns (Ghana Health Service, 2015). Non-governmental organisations such as Planned Parenthood Association of Ghana, Ghana Social Marketing Foundation, The African Youth Alliance, Marie Stopes International Ghana and Hope for Future Generation have worked together to minimize or eradicate the drivers of teenage pregnancy in Ghana (Ghana Health Service, 2016).

A plethora of studies has attempted to understand the determinants of pregnancy in Africa among teenage girls. Studies have shown that economic factors such as poverty discourage caregivers from ensuring that their teenage girls are exposed to life choices, rendering them vulnerable to unintended pregnancies (Atuyamba, Mirembe, Johansson Kirumira and Faxelid, 2005; Cooke et al., 2016; Asare et al., 2019). Besides, numerous studies have revealed socio-cultural factors such as unequal gender power control, early marriage, adverse cultural beliefs and practices, religion, insufficient or lack of sex education at home and school, and coercive sexual relations as factors that predispose adolescents in Sub-Saharan Africa to teenage pregnancy (Gyan, 2013; Krugu et al., 2016; Faisal-Cury et al., 2017; Krugu et al., 2017). Furthermore, environmental factors such as inadequate forms of recreation, lack of affordable education, peer influence and parenting styles make a significant contribution to adolescent pregnancy (Hindin and Fatusi, 2009; Mushwansa et al., 2015; Yakubu and Salisu, 2018; Gunawardena et al., 2019). Besides, adult sexual abuse, excessive alcohol use, substance abuse, curiosity, low educational status, low self-esteem and misconceptions about contraceptives are the individual determinants of adolescent pregnancy in sub-Saharan Africa (Adzitey et al., 2011; Mchunu et al., 2012; Yidana et al., 2015; Yakubu and Salisu, 2018). On the other hand, a literature review by (Gunawardena et al., 2019) found that adolescents in Sub-Saharan Africa are at greater risk of becoming pregnant at early stages of life due to non-friendly adolescent reproductive services in healthcare facilities, lack of sexual health awareness given by healthcare workers and derogatory attitudes of health workers towards adolescents.

Not enough scholarly attention has been given to the correlation between adequate knowledge of HIV transmission and the lower probability of pregnancy and childbirth among adolescents. Interestingly, the same preventive protocols for avoiding pregnancy are the main elements of HIV prevention education: abstinence from sex or use of a condom during sexual intercourse (Lemessa et al., 2013; Gemechu et al., 2015;

Badru et al., 2020). Given that Ghana, through financial and program assistance from government and multinational and local organizations, has invested heavily in HIV education and intervention programs (Agyemang et al., 2012; Asante and Oti-Boadi, 2013; Kunu et al., 2014), we hypothesised that Ghanaian adolescent girls who are adequately aware of how HIV is transmitted may have a lower likelihood of becoming pregnant before their 18th birthday.

1.1. Conceptual framework: The Health Belief Model (HBM)

The Health Belief Model (HBM) is the conceptual framework underpinning the study. The HBM has the following five main constructs: Perceived Susceptibility; Perceived Severity; Perceived Benefits; Perceived Barriers; Cues to Action; Self-Efficacy (Glanz et al., 2008; Rosenstock, 1974). These constructs are known to lead, collectively, to the adoption of an acceptable health behaviour or participation in screening or preventive activities. Therefore, a person who believes he/she is highly susceptible to a disease such as HIV (perceived susceptibility), and who also subsequently knows the extent of the impact of contracting HIV—physical effects, social effects, or, in the worst-case, his/her premature death (perceived severity)—is likely to take any action to prevent HIV such as abstaining from sex or wearing a condom.

However, before the individual undertakes such preventive methods, the person must conclude that abstinence or the use of condoms will lead to a reduced risk of developing the disease (perceived benefits). Perceived benefit alone does not cause behavioural change when a person sees significant challenges while trying to adopt healthy behaviour (perceived barriers). For example, in the previous example, an individual may not use a condom if he thinks that condoms are expensive or if he believes that condom use will affect his sexual satisfaction.

The framework also assumes that a person's decision to use a condom will not be spontaneous in some cases, and therefore certain extrinsic and intrinsic factors may cause an individual to act (Cue to action). In the above example, cues that can trigger a person's use of a condom (for example) may be a short street advertisement such as "HIV is real! Please wear a condom!" Add which the individual sees by chance while using the road or social media that pops up when using a mobile device on the screen. Finally, the individual should be convinced that a behavioural change can be carried out successfully (Self-efficacy). We hypothesized in this study that adolescents with sufficient HIV awareness are more likely to recognize that HIV is real and that they may be infected (Perceived susceptibility). They are also more likely to understand that HIV is a serious condition and therefore a need to prevent it. These girls are therefore more likely to appreciate the benefits of condom use and abstinence in HIV prevention. These healthy behavioural choices, while directed towards HIV prevention, also help prevent pregnancy among adolescent girls.

2. Methods

2.1. Study design

The study used the 2017–2018 Multiple Indicator Cluster Survey Six (MICS-6) data of Ghana (Ghana Statistical Service, 2018). The Ghana statistical service (GSS) in collaboration with the Ghana Health Service (GHS), and Ministry of Health (MOH) undertook the MICS-6. Other supporting institutions in the collection of the MICS-6 data were the Ministry of Sanitation and Water Resources, Ministry of Gender, Children and Social Protection, Ministry of Education, and the Ghana Education Service. The MICS-6 employed a two-stage sampling approach to select primary sampling units, households, and individuals. The first stage was the selection of primary sampling units or cluster. The census frame from which clusters were selected included all enumerations areas that were demarcated for the 2010 population and housing census in Ghana. Therefore, enumeration areas represented the clusters. In the first stage, clusters were randomly selected. The clusters were stratified by place of

residence to account for the rural-urban representation. In all, 342 and 318 clusters were selected from rural and urban areas, respectively. A total of 660 clusters were randomly selected in the first stage. The second stage involved the systematic selection of households from selected clusters. About 20 households were averagely selected from each cluster making a total of 13,202 households with 6,841 and 6,361 from rural and urban areas, respectively. Twelve thousand nine hundred and sixty (12,960) of the selected households were occupied, and respondents were interviewed from 12,886 households representing a response rate of 99.4%. Interviews on a wide range of issues were conducted for all women in selected households aged 15–49.

2.2. Data collection, access, and analytic sample

Data were collected by trained enumeration officers on behalf of the GSS and UNICEF. Data used for analysis is freely accessible at the Global MICS Programme's page at <https://www.unicef.org/ghana/reports/ghana-multiple-cluster-indicator-survey>. Data was downloaded after permission was obtained by the last author. We used the female dataset for our study, and the dataset contains 14,609 cases of women within the age of 15–49 years. Subpopulation analysis was performed on 5,836 cases (weighted as 5121) of 15–24 years old women in the female dataset.

2.3. Study variables

The main outcome under investigation was pregnancy before age 18 years among reproductive age women between 15–24 years. This was measured as a binary response (Yes or No). The main predictor was accurate knowledge of HIV transmission. Six main questions were asked to explore women's knowledge about HIV transmission. These questions with their correct responses included: One can avoid HIV by having one uninfected partner (Answer: Yes), Can get HIV from mosquito bites (Answer: No), Can avoid HIV by using a condom correctly every time (Answer: Yes), Can get HIV by sharing food with a person who has HIV (Answer: No), Can get HIV through supernatural means (Answer: No), and Healthy-looking person may have HIV (Answer: Yes). Therefore, cumulative accurate scores for each respondent were computed with a score of 6 implying perfect correct score while a score of 5 means the respondent got only one of the responses wrong etc. A score of "1" implies only a single correct response etc. This variable was ordered with a maximum score of "6" (perfect knowledge) and a minimum score of "0" (for incorrect responses in all 6). Other covariates included education, household wealth, and place of residence and region of residence. Household wealth quintile was already estimated and reported in the MICS dataset. The wealth quintile was created using household characteristics (source of drinking water, type of toilet, sharing of toilet facilities, the main material for the roof, and walls and floor materials amongst other household characteristics) and household possessions and assets (ownership of television, radio, vehicle, bicycles, motorcycles, watch, agricultural land, farm animals/livestock, and bank account amongst others).

2.4. Data analysis

Data was initially cleaned in SPSS. Data analysis was done in three stages: univariate, bivariate, and multivariate analysis. All analyses were weighted to account for sample design. In the bivariate analysis, a chi-square test for independence was performed to assess the association between socio-demographic variables and adolescent pregnancy status. We used a generalized linear model (glm) in STATA setting the family to "Poisson" to produce prevalence ratio (PR) estimates instead of using a logistic model to report odd ratio. Before this, we adjusted for the complex sample design (primary sampling units, stratification and sampling weights) of the MICS-6 by using the "svyset" command in STATA. This helps to avoid any potential bias of the standard errors of the confidence

interval the PR estimates. We provided both crude and adjusted PR estimates of adolescent pregnancies.

2.5. Ethics

Coordinators of the MICS-6 obtained ethical clearance from the Ministry of Health (MOH), Ghana. Given that this is secondary data analysis, we did not obtain any additional ethical clearance beyond the permission to use the data for our study.

3. Results

3.1. Sample characteristics

In the dataset, 816 (15.9%) got pregnant or gave birth before their 18th birthday (Table 1). Majority of the participants had attained a junior secondary school level qualification (47.8%) (Table 1). A little over half of the participants were in rural areas (50.4%) (Table 1). Many of the participants got the answers on knowledge of HIV transmission correct. Detail reports of the sample characteristics are presented in Table 1.

3.2. Relationship between knowledge of HIV/AIDS transmission and adolescent pregnancy

Six questions in the dataset measured reproductive-age women's knowledge of HIV transmission in Ghana. In line with our main research question, we used the Chi-square test of independence to perform a preliminary assessment of the relationship between adolescent pregnancy and knowledge of HIV transmission among the study participants. There was a statistically significant association between three of the questions assessing knowledge of HIV transmission and adolescent pregnancy status (see Table 2). An interesting finding was that majority of the participants who got pregnant before their 18th birthday wrongly thought that HIV could be transmitted through spiritual means (61.6%) (see Table 2).

To accurately measure the participant's knowledge, we computed a composite score for each participant representing the number of questions he/she answered correctly. Zero is the lowest mark a participant can get and six is the highest mark. Using Poisson regression to perform bivariate analysis, we tested the relationship between having accurate knowledge of HIV transmission and adolescent pregnancy. We have added a supplementary table that provides descriptive information of the associations observed in Model I (see S Table 1).

The results indicate that having lower scores on the HIV transmission knowledge scale was associated with a higher probability of girls becoming pregnant before their 18th birthday (Table 3). After controlling for the moderating effect of socio-demographic characteristics of the participants, we, however, found that accurate HIV transmission knowledge loses its statistical significance in determining adolescent pregnancy (Table 3). The factors that remain significant in the adjusted model were formal education qualification status, household wealth, and region of residence (Table 3). We tested another model that excluded the formal education variable to ascertain its effect on the outcome (Table 3). By this procedure, we established how much of the relationship between HIV transmission and adolescents pregnancies are explained by all the other variables (Model II) and how much is explained by the education variable (model III in comparison to model II) (Table 3). This procedure helped in understanding the relationship between all the confounding variables in our model.

In model II, HIV transmission knowledge was not statistically significant. In model III, after excluding the education level variable, HIV transmission knowledge was statistically significantly related to adolescent pregnancy (Table 3). This observation suggests that school education is a prerequisite to know about HIV transmission. Therefore, adjusting for school education in the multivariable model, it makes sense for the effect of knowledge of HIV-transmission to disappear, as this

Table 1. Weighted summary statistics of the study variables.

	N	%
Adolescent pregnancy status		
Yes	816	15.9
No	4305	84.1
Knowledge of HIV transmission		
Can avoid HIV by having one uninfected partner		
No	1212	23.7
Yes ^{ca}	3909	76.3
Can get HIV from mosquito bites		
No ^{ca}	3945	77.0
Yes	1176	23.0
Can avoid HIV by using a condom correctly every time		
No	1642	32.1
Yes ^{ca}	3479	67.9
Can get HIV by sharing food with a person who has HIV		
No ^{ca}	3577	69.8
Yes	1545	30.2
Can get HIV through supernatural means		
No ^{ca}	2797	54.6
Yes	2325	45.4
A healthy-looking person may have HIV		
No	1406	27.5
Yes ^{ca}	3715	72.5
Education		
None	278	5.4
Early Edu/Primary	752	14.7
JSS/JHS	2447	47.8
SSS/SHS+	1644	32.1
Household wealth		
Poorest	897	17.5
Second	1000	19.5
Middle	1134	22.2
Fourth	1064	20.8
Richest	1026	20.0
Place of residence		
Urban	2542	49.6
Rural	2579	50.4
Region of residence		
Western	518	10.1
Central	542	10.6
Greater Accra	623	12.2
Volta	400	7.8
Eastern	624	12.2
Ashanti	1184	23.1
Brong Ahafo	481	9.4
Northern	454	8.9
Upper East	171	3.3
Upper West	124	2.4

JSS/JHS: Junior secondary school; SSS/SHS: Senior secondary school; ca: Correct answer.

knowledge is dependent on school education. These results indicate that HIV transmission knowledge has a significant relationship with an adolescent's lower likelihood of becoming pregnant before her 18th birthday.

Compared to adolescents who had attained a senior secondary school level, adolescents with lower or no educational qualification had a higher likelihood of becoming pregnant before their 18th birthday: JSS/JHS [APR = 4.89, CI: 3.52, 6.79], Early Education/Primary [APR = 9.24, CI: 6.55, 13.03], and None [APR = 9.43, CI: 6.38, 13.93] (Table 3).

Compared to adolescents in the richest households, the probability for adolescents to become pregnant before their 18th birthday was higher when they were in richer [APR = 3.08, CI: 2.05, 4.63], middle [APR = 4.65, CI: 3.07, 7.06], poorer [APR = 4.65, CI: 3.07, 7.06], and the poorest households [APR = 3.83, CI: 2.52, 5.82] (Table 3). Compared to adolescents in the Greater Accra region, dwelling in the following regions decreased their probability of adolescent's becoming pregnant before their 18th birthday: Northern [APR = 0.47, CI: 0.30, 0.74], Upper East

Table 2. Chi-square test of independence between adolescent pregnancy status and knowledge of HIV transmission.

Knowledge of HIV transmission	APS		
	Yes	No	
	n (%)	n (%)	
Can avoid HIV by having one uninfected partner			$\chi^2 = 1.50, p = 0.39$
No	180 (22.1)	1032 (24.0)	
Yes ^{CA}	635 (77.9)	3273 (76.0)	
Can get HIV from mosquito bites			$\chi^2 = 32.30, p < 0.001$
No ^{CA}	570 (69.8)	3375 (78.4)	
Yes	246 (30.2)	930 (21.6)	
Can avoid HIV by using a condom correctly every time			$\chi^2 = 3.60, p = 0.18$
No	240 (29.4)	1402 (32.6)	
Yes ^{CA}	576 (70.6)	2903 (67.4)	
Can get HIV by sharing food with a person who has HIV			$\chi^2 = 22.44, p < 0.001$
No ^{CA}	517 (63.3)	3060 (71.1)	
Yes	299 (36.7)	1245 (28.9)	
Can get HIV through supernatural means			$\chi^2 = 1.50, p < 0.001$
No ^{CA}	313 (38.4)	2484 (57.7)	
Yes	503 (61.6)	1822 (42.3)	
A healthy-looking person may have HIV			$\chi^2 = 3.76, p = 0.16$
No	203 (24.9)	1203 (27.9)	
Yes ^{CA}	613 (75.1)	3103 (60.6)	

CA: Correct answer; APS: Adolescent Pregnancy Status.

[APR = 0.60, CI: 0.38, 0.93], and Upper West [APR = 0.50, CI: 0.32, 0.76] (Table 3).

4. Discussion

We tested the hypothesis that a lower risk of teenage pregnancy in Ghana was correlated with the correct knowledge of HIV transmission.

At the crude level of analysis, our study found a significant association between knowledge of HIV transmission and adolescent pregnancy. However, the impact of accurate awareness of HIV transmission on the lower risk of adolescent pregnancy was lost after adjusting for socio-demographic variables at the individual and household levels, such as the level of education of the respondent, household income, and region of residence. After excluding the education level variable, HIV transmission knowledge was statistically significantly related to adolescent pregnancy in the model. This observation was due to the significant effect of school education on other variables in the model. This result indicates that HIV knowledge has a significant influence on adolescent pregnancy, but this effect is predicated by formal education attainment of the adolescent girl. This suggests that programs and interventions that enhance other aspects of adolescents' socio-demographic conditions have the potential to reduce pregnancy among adolescents in Ghana.

Our findings are consistent with previous studies which have shown that having accurate knowledge of HIV is significantly associated with precautionary sexual behaviour (Kunu et al., 2014; Badru et al., 2020). Achieving formal education is a protective factor against pregnancy among adolescents in Ghana. This finding emphasizes the multidimensional positive impact of formal education on the empowerment of girls and women (Shumuga et al., 2015; Khan et al., 2020). As girls become well-informed through education, they are empowered to make choices that promote their wellbeing and future aspirations (Khan et al., 2020). Several studies have shown that school-going teenagers are more likely to have appropriate sex education awareness and to be more inclined to engage in healthy sexual behavioural activities (Hau, 2011; Rashid and Mwale, 2016; Kumar, 2017; Leung et al., 2019). Given the positive effect of attainment of formal education on adolescent pregnancy as amplified by our study and the general adolescent pregnancy literature (Masuda and Yamauchi, 2017; Mohr et al., 2019), it is important that mass access

to formal education, with an emphasis on empowering the girl child, becomes central in all policies, programs, and interventions of government and other development partners in Ghana. However, other studies also found that HIV knowledge has little to no significance in reducing the likelihood of adolescent pregnancy (Boonstra, 2007; Kachur et al., 2013; Govender et al., 2019).

The likelihood that girls will become pregnant before their 18th birthday increases when they belong to households with a lower quantity of wealth compared to the highest quantity of wealth. A possible explanation may be that the resources that allow them to buy contraception could be accessible to girls from rich homes. Also, richer homes provide the foundation for adolescent girls to aspire for higher education and quality of life. To achieve these aspirations, these adolescent girls may keep themselves from engaging early sexual initiation or unprotected sexual intercourse. Also, household wealth, in general, is associated with quality health, welfare, and socioeconomic outcomes in sub-Saharan Africa (Moratti, and Natali, 2012; Zereyesus et al., 2016; Lenhart, 2019). Therefore, in our research, the link between household wealth and adolescent pregnancy shows that addressing economic disparity and embarking on initiatives to reduce poverty can potentially eradicate other social ills in Ghana (Ahorlu, Pfeiffer and Obrist, 2015). Our results are consistent with the findings of other scholars who have found that poverty is one of the main determinants of adolescent pregnancy in Ghana (Amponsem-Boateng, Acheampong, Ganu and Amponsah-Gyan, 2018), in sub-Saharan Africa (Yakubu and Salisu, 2018), and in other low-and-middle-income countries (Lambani, 2017).

In our analysis, we found regional variations in the prevalence of adolescent pregnancy in Ghana. Residing in the three northern regions reduces the prevalence of adolescent pregnancy among adolescent girls compared to girls residing in Greater Accra. A possible explanation for this finding is the frequent migration of adolescents from rural areas to the capital cities in Ghana (Kwankye et al., 2009). Generally, adolescents and young migrant women are most often exposed to multiple risk factors of teenage pregnancy (UNICEF, 2014). Ordinarily, adolescents migrate without any expertise and reliable accommodation. Once they arrived at the capital cities, they engage in jobs such as head portering, domestic work and prostitution which expose them to rape and sexual activities leading to unplanned pregnancies (Christensen et al., 2011). Besides,

Table 3. Relationship between knowledge of HIV transmission and adolescent pregnancy status.

variables	Model I	Model II	Model III
	PR [95% CI of PR]	APR [95% CI of APR]	APR [95% CI of APR]
Knowledge of HIV/AIDs transmission			
6 points	1	1	1
5 points	1.66* [1.22, 2.26]	1.29 [0.96, 1.74]	1.52** [1.11, 2.07]
4 points	2.14* [1.58, 2.90]	1.30 [0.97, 1.74]	1.77** [1.31, 2.40]
3 points	2.42* [1.66, 3.03]	1.10 [0.81, 1.49]	1.74** [1.28, 2.37]
≤2 points	1.96* [1.34, 2.88]	0.92 [0.62, 1.36]	1.53** [1.05, 2.24]
Education			
SSS/SHS+	1	1	-
JSS/JHS	4.89* [3.52, 6.79]	3.84* [2.72, 5.42]	-
Early Education/Primary	9.24* [6.55, 13.03]	7.57* [5.26, 10.91]	-
None	9.43* [6.39, 13.93]	8.82* [5.83, 13.34]	-
Household wealth			
Richest	1	1	1
Richer	3.08* [2.05, 4.63]	2.14* [1.44, 3.16]	2.92** [1.94, 4.41]
Middle	3.83* [2.52, 5.82]	2.32* [1.54, 3.48]	3.46** [2.24, 5.36]
Poorer	4.65* [3.07, 7.06]	2.44* [1.59, 3.77]	4.10** [2.60, 6.44]
Poorest	4.85* [3.24, 7.26]	2.52* [1.61, 3.93]	4.64** [2.91, 7.40]
Place of residence			
Urban	1	1	1
Rural	1.77* [1.48, 2.11]	1.13 [0.92, 1.39]	1.24 [1.00, 1.54]
Region of residence			
Greater Accra	1	1	1
Western	1.77* [1.22, 2.56]	1.13 [0.78, 1.64]	1.06 [0.73, 1.54]
Central	1.51* [1.01, 2.26]	1.01 [0.69, 1.49]	0.94 [0.64, 1.39]
Volta	1.79* [1.11, 2.88]	0.89 [0.54, 1.47]	0.93 [0.56, 1.54]
Eastern	2.04* [1.42, 3.08]	1.25 [0.86, 1.84]	1.25 [0.85, 1.83]
Ashanti	1.38 [0.95, 2.00]	1.00 [0.70, 1.43]	0.92 [0.65, 1.31]
Brong Ahafo	1.36 [0.90, 2.05]	0.83 [0.56, 1.23]	0.80 [0.53, 1.20]
Northern	1.12 [0.72, 1.74]	0.47* [0.30, 0.74]	0.53* [0.33, 0.86]
Upper East	1.34 [0.87, 2.05]	0.60** [0.38, 0.93]	0.61* [0.40, 0.96]
Upper West	1.09 [0.71, 1.68]	0.50* [0.32, 0.76]	0.51* [0.33, 0.80]

* p-value ≤ 0.01; ** p-value ≤ 0.05; PR: Prevalence Ratio; APR: Adjusted Prevalence Ratio.

Model I: bivariate analyses between covariates and the outcome.

Model II: multivariable model including all confounders.

Model III: multivariable model excluding the adolescent level of formal education.

adolescent migrants usually rely on their intimate partners for accommodation and financial support making it difficult to negotiate for sex and contraceptive use (Akinsulure-Smith et al., 2013). This greater vulnerability of these girls in such a large city could lead to a predisposition to risky sexual behaviours, which may lead to pregnancy (Asnong et al., 2018; Ghana Demographic and Health Survey, 2014). We suggest that research should be undertaken on how to establish approaches or initiatives that could more directly benefit girls (with little education) who have migrated to the cities from rural areas to strengthen their skills in various related ways (sex negotiation, income generation, etcetera.).

4.1. Strength and limitation

The greatest strength of the study is that the data underlying the results are nationally representative, making it possible for the results to be generalized for the entire nation. Using secondary data means that we are limited to only variables available in the dataset. Thus, we could not control for variables that measure knowledge aspect more proximal to adolescent pregnancy such as knowledge about the reproductive system, about condom use and other pregnancy preventive measures.

5. Conclusion

In this study, we analysed data from the 2017 Multiple Cluster Indicator Survey to determine the relationship between knowledge of HIV transmission and adolescent pregnancy in Ghana. We found a significant relationship between HIV transmission knowledge and adolescent pregnancy at the crude level of analysis. However, the effect of the accurate knowledge of HIV transmission on lowering the likelihood of pregnancy was lost after adjusting for individual and household level socio-demographic factors such as respondent's level of education, household wealth, and region of residence. Based on the current findings, we recommend that the government and its relevant bodies and institutions such as the AIDS Commission should strengthen and embark on a continuous, conscious and targeted education and awareness creation on HIV and enrich adolescents' understanding of the risks associated with inadequate HIV knowledge. Notwithstanding this, we emphasise other necessary measures to address inequalities in education and wealth through the provision of social security and opportunities for wealth creation. Successful HIV and adolescent pregnancy prevention outcomes can only be achieved through a comprehensive plan that includes conscientisation, formal

education and poverty reduction strategies in the country. Adolescents in poorer communities and low-income families should be granted free and easy access to sexual and reproductive health services.

Declarations

Author contribution statement

Emmanuel Brenyah Adomako, Kwabena Frimpong-Manso and Petronella Munemo: Conceived and designed the experiments; Wrote the paper.

Pascal Agbadi: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Henry Ofori Duah: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data associated with this study has been deposited at UNICEF's Global MICS Programme: <https://www.unicef.org/ghana/reports/ghana-multi-cluster-indicator-survey>.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

Supplementary content related to this article has been published online at <https://doi.org/10.1016/j.heliyon.2021.e06265>.

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