



Prevalence and correlates of HIV/AIDS knowledge among ever married women of reproductive age in Bangladesh: an update from the Bangladesh Demographic and Health Survey 2014

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ABSTRACT

Background: Knowledge about Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) is crucial to prevent the HIV/AIDS disease burden, especially for the women of reproductive age to protect their offspring from mother-to-child transmissions of HIV/AIDS. This study aims to explore the prevalence and correlates of HIV/AIDS knowledge among ever-married reproductive women in Bangladesh.

Methods: Data were extracted from a nationally representative two-stage stratified Bangladesh Demographic and Health Survey conducted in 2014. The knowledge level of women regarding HIV/AIDS was constructed by scoring 11 dichotomous knowledge questions and classified into low, moderate, and high level by using the principal component analysis. Multiple multinomial logistic regression model was fitted to identify the correlates.

Results: Among 17,863 ever-married women of reproductive age, 70% had ever heard about HIV/AIDS, and 34.2% had low, 33.0% had moderate, and 32.8% had high level of HIV/AIDS knowledge. Women with age at first marriage between 15 and 19 years and ≥ 20 years of age were, respectively, 1.18 and 1.85 times more likely to have high HIV/AIDS knowledge than women who got married before 15 years of age. Compared to illiterate women, women who have completed primary and secondary or higher education had higher odds of having both moderate and high HIV/AIDS knowledge. Women exposed to mass media were 2.39 and 2.91 times more likely to have moderate and high HIV/AIDS knowledge respectively than women without mass-media exposure.

Conclusions: Findings of this study stress the importance of building awareness regarding the transmissions and consequences of HIV/AIDS among women of reproductive age in order to avert the risk of further spread. Through promotion of female education, incorporation of HIV/AIDS teaching in the national curriculum and vigorous mass media campaigns, women's awareness about HIV/AIDS can be enhanced effectively. Also, strict enforcement of policy to prevent early marriage will aid in better control of HIV in Bangladesh.

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Introduction

Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) has been recognized as a major public health concern for more than two decades [1]. Globally, 35 million people have died of AIDS related causes, and as of 2018, about 37.9 million are living with HIV. In sub-Saharan Africa, HIV/AIDS accounts for 71% of the global deaths and in Asia-Pacific, the HIV/AIDS related deaths increased 11% from 2000 to 2014 [1–4].

In Bangladesh, the first HIV case was detected in 1989 [5,6]. Since then, it is estimated that about 14,000 people are living with HIV in Bangladesh [7]. Although the current HIV prevalence is low in Bangladesh (less than 0.1%), people belonging to Key Populations including female sex workers, people who inject drugs (PWID), transgender women (locally known as hijra), and men who have sex with men (MSM) are more prone to contracting HIV [5,8]. In addition, migrant workers, individuals living near borders, homeless people, and truck drivers are also at higher risk of being infected with HIV due to their participation in risky behaviors, such as unprotected sexual intercourse with infected and multiple partners, contaminated blood transfusion, and sharing of contaminated needles, syringes, or other sharp instruments [5,8–15]. Recently, with the influx of forcibly displaced Myanmar Nationals or the Rohingya people, a community known to be susceptible to HIV infection due to higher exposure, the risk of an HIV/AIDS epidemic is increased, especially in the southern part of the country [16]. Bangladesh is the only country in South Asia where HIV prevalence has increased among PWID due to increased sharing of syringes and needles [17].

Knowledge about HIV/AIDS is crucial for preventing the transmission of the infection, and thus mitigating this burden [18]. It is important to have an up-to-date discussion about the extent of knowledge on HIV/AIDS amongst ever-married women of reproductive age since they are more vulnerable to HIV infection and mortality compared to men, as well as HIV transmission to their offspring [19]. Women are getting infected at a faster rate and are more vulnerable than men because, biologically, women expose a greater mucus area during penile penetration and experience hormonal changes [20,21]. Vaginal microbial ecology and physiology also play a role [20,21]. Furthermore, younger women have an underdeveloped cervix and low vaginal mucus production [20]. In addition to biological factors, there are social factors, including

gender disparities, poverty, cultural and sexual norms, lack of education, and violence, which are responsible for women's vulnerability towards HIV/AIDS [21]. To our knowledge, in Bangladesh, limited studies have been conducted in order to explore correlates of people's knowledge level of HIV/AIDS. Moreover, some studies explored the correlates of HIV/AIDS by measuring knowledge and awareness according to if women had ever heard of HIV/AIDS [22–24]. This is insufficient as it does not appropriately assess the level of knowledge respondents have about HIV/AIDS. Therefore, in this study, we aimed to explore the prevalence and correlates of knowledge level of HIV/AIDS among ever-married women of reproductive age in Bangladesh.

Methodology

Data source

We used data of 17,863 ever-married women of reproductive age from the Bangladesh Demographic and Health Survey (BDHS) 2014, the seventh round of a nationally representative, cross-sectional survey which is a part of the global Demographic and Health Surveys program. To date, the 2014 BDHS is the most updated data providing information on HIV/AIDS knowledge of reproductive women at a national level. The 2014 BDHS employed a two-stage stratified sampling technique to survey the respondents' households. In the first stage of sampling, 600 clusters (enumeration areas) were selected throughout Bangladesh with 207 in urban and 393 in rural areas. The respondents of this survey were ever-married women of reproductive age (15–49 years). The 2014 BDHS compiles information on a variety of socio-demographic and health-related indicators, including socio-economic status of household, fertility and reproductive health, maternal and newborn health, nutritional status of women and children, women's empowerment, healthcare-seeking behavior, and knowledge, attitude and behavior regarding HIV/AIDS, and other sexually transmitted infections (STI).

Outcome measure

The outcome variable for this study was the level of knowledge regarding HIV/AIDS of the respondents in question, classified as either low, moderate, and high. The BDHS 2014 used a set of 11 highly inter-related (Cronbach Alpha = 0.92) questions to measure the HIV/AIDS knowledge among ever-married women of reproductive age at the national level.

The response of these questions were recorded as yes, no, and don't know. For the purpose of this study, we created binary variables for each of the 11 questions. When creating binary variables, we first identified the questions for which a "Yes" response would denote the respondents having knowledge regarding HIV. For such questions, we coded this "Yes" response as 1 and the remaining two categories ("No" and "Don't know") were coded as 0. Here, the code 0 stands for having "No knowledge" and 1 stands for "Have knowledge". For the questions to which the "No" response denotes the respondents

having knowledge regarding HIV, we recoded these variables so the "No" response were coded as 1 and the remaining two categories ("Yes" and "Don't know") were coded as 0. Similarly, the code 0 stands for having "No knowledge" and 1 stands for "Have knowledge" for these recoded variables. All the questions that were recoded to generate knowledge scores are presented in Supplementary Table 1. This procedure allowed us to treat all the "having knowledge" responses with code 1 and "no knowledge" responses with code 0. Then, we created a composite knowledge variable by adding

Supplementary Table 1. Converting original variables to create binary variables for generating knowledge

Questions related to HIV/AIDS knowledge	Original coded value	Original label	Recoded value	Revised label
People get AIDS virus by unsafe blood transfusion	0	No	0	No knowledge
	1	Yes	1	Have knowledge
	9	Don't know	0	No knowledge
People get the AIDS virus by using unsterilized needle or syringe	0	No	0	No knowledge
	1	Yes	1	Have knowledge
	9	Don't know	0	No knowledge
People can get the AIDS virus because of witchcraft or other supernatural means	0	No	1	Have knowledge
	1	Yes	0	No knowledge
	9	Don't know	0	No knowledge
AIDS transmitted from mother to her baby by breastfeeding	0	No	0	No knowledge
	1	Yes	1	Have knowledge
	9	Don't know	0	No knowledge
AIDS transmitted from mother to her baby during delivery	0	No	0	No knowledge
	1	Yes	1	Have knowledge
	9	Don't know	0	No knowledge
AIDS transmitted from mother to her baby during pregnancy	0	No	0	No knowledge
	1	Yes	1	Have knowledge
	9	Don't know	0	No knowledge
It is possible a healthy looking person can have AIDS virus	0	No	0	No knowledge
	1	Yes	1	Have knowledge
	9	Don't know	0	No knowledge
People get AIDS by sharing food with a person who has AIDS	0	No	1	Have knowledge
	1	Yes	0	No knowledge
	9	Don't know	0	No knowledge
People get AIDS virus from mosquito bites	0	No	1	Have knowledge
	1	Yes	0	No knowledge
	9	Don't know	0	No knowledge
People can reduce their chance of getting the AIDS virus by having just one uninfected sex partner, who has no other sex partners	0	No	0	No knowledge
	1	Yes	1	Have knowledge
	9	Don't know	0	No knowledge
People can reduce their chance of getting the AIDS virus by using a condom every time they have sex	0	No	0	No knowledge
	1	Yes	1	Have knowledge
	9	Don't know	0	No knowledge

all of the 11 dichotomous variables to give us the knowledge score of the participants. We performed principal component analysis to generate principal component scores for HIV knowledge [25]. We divided the participants into three terciles based on the scores drawn from principal component analysis. We checked the subsequent scores drawn by adding the 11 dichotomous questions to classify the HIV/AIDS knowledge level into three groups: groups with high, moderate, or low knowledge.

Covariates measure

To select the covariates relevant to HIV/AIDS knowledge, an extensive literature review was carried out and a conceptual framework is presented to show the hypothesized relationship between different related factors with outcomes in Figure 1. The independent variables used in this study included respondent's age (categorized as: 15–24, 25–34, and ≥ 35 years), respondent's age at first marriage (<15, 15–19, and ≥ 20 years), place of residence (Urban, Rural), respondent's current employment status (Unemployed, Employed), respondent's education level (Illiterate, Primary, Secondary, or Higher), use of condom by the husband of ever-married women during sexual intercourse as a current contraceptive method (Not using, Using), administrative divisions (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, Sylhet), and wealth quintile (Poorest, Poorer, Middle, Richer, Richest). Women's exposure to mass-media was characterized in terms of reading newspapers, listening to the radio, or watching television. Answering "yes" on the survey indicated that the woman consulted one of these types of media at least once a week.

Statistical analysis

We calculated descriptive statistics for the socio-demographic characteristics of the study population and the HIV/AIDS knowledge level of respondents and presented these as percentages and frequencies. We presented the respondents' knowledge responses in a similar way, and present the yes response in Figure 2. For constructing knowledge score, we assigned 1 score to each "having knowledge" response, and 0 to all other responses. Bivariate analysis was performed to see the correlates of HIV/AIDS knowledge level by the selected sample characteristics. In the bivariate analysis, the chi-square test of independence was used to find out the statistical association between HIV/AIDS knowledge level and sample characteristics. All the univariate and bivariate analyses were done by taking into account the complex survey design for capturing variations due to weighting and study design. Simple multinomial logistic regression was also performed to find out the potential correlates for the final model and presented in crude odds ratio with 95% confidence interval (CI) (Supplementary Table 2). Finally, multiple multinomial logistic regression analysis was employed to explore the correlates of HIV/AIDS knowledge level of participants. The results of multiple multinomial logistic regression were presented in adjusted odds ratio with 95% CI. We checked the multicollinearity among the covariates in the multiple regression model and found variance inflation factor <1.90. Moreover, we did sensitivity analysis to see the pattern of associated factors using multiple negative binomial regression and presented the results in

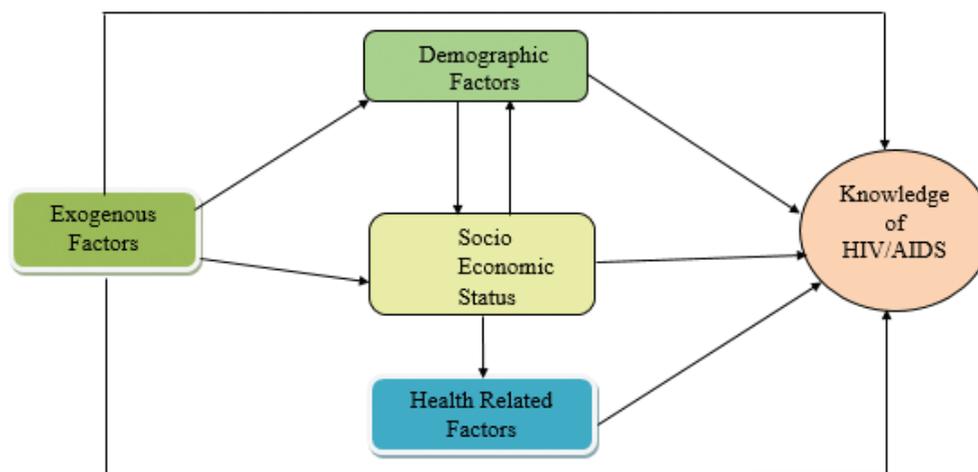
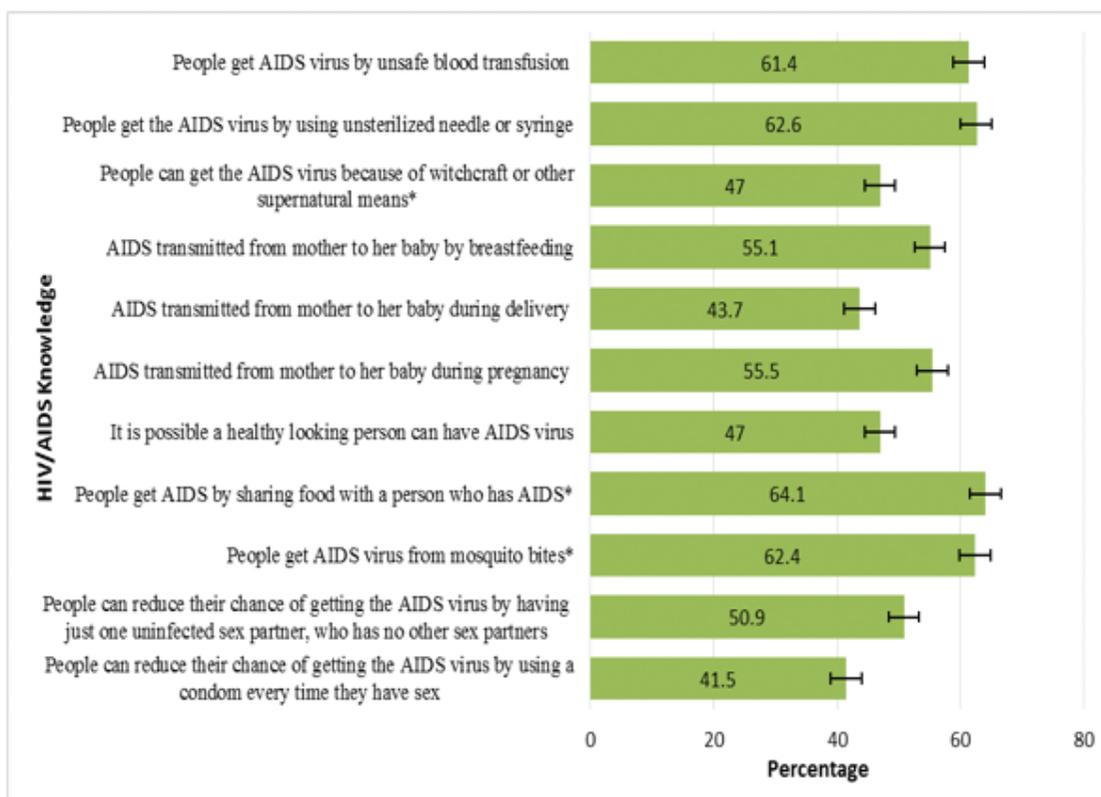


Figure 1. Conceptual framework of HIV/AIDS knowledge.



*Who responses as yes, actually they did not have correct knowledge of these responses

Figure 2. Percentage distribution of HIV/AIDS related responses.

adjusted incidence rate ratio with respective 95% CI (Supplementary Table 3). In order to capture cluster variations, all regression analyses were performed using the “cluster” command in statistical software package STATA, version 14.1.

Results

Sample characteristics

The sample characteristics are presented in Table 1. The results showed that 54.7% of the women were 15–19 years old at their first marriage with average age 16.5 (SD = 1.3) years (not shown in table). Almost half (45.9%) of the respondents completed secondary or higher education and about one-fourth (24.9%) were illiterate. About two-third (66.9%) of the women were unemployed. The majority (72%) of the women were living in the rural areas, and media exposure among the women was 62.5%. Only 6.1% of the women reported the use of condoms by their husbands as a contraceptive method during sexual intercourse. Out of seven administrative divisions, the highest percentages of women lived in Dhaka division (34.8%) and lowest in Sylhet division (6.9%).

Knowledge about HIV/AIDS and its determinants

Study findings showed that about 70% of ever-married women aged 15–49 years had ever heard of AIDS. Figure 2 demonstrates the response to HIV/AIDS related questions among ever-married women of reproductive age. About 40% respondents claimed that condom use can protect HIV/AIDS transmission whereas 50.9% respondents mentioned that HIV/AIDS transmission can be prevented by having sex with one partner who has no other partners. Regarding the common misconceptions related to HIV transmission, about 50% of the respondents reported that people can get AIDS by witchcraft or supernatural means, 62.4% reported that HIV can be transmitted by mosquito bites, and 64.1% mentioned people can get AIDS by sharing food.

Figure 3 depicts the percentage distribution of low, moderate, and high HIV/AIDS knowledge levels among the respondents, based on their ability to correctly answer 11 HIV/AIDS related questions. Approximately, one-third of the respondents had low knowledge, 33.0% had moderate, and 32.8% had high knowledge about HIV/AIDS. We also observed significant difference ($p < 0.001$) of high

Supplementary Table 2. Crude Odds ratio of knowledge level regarding HIV/AIDS among ever-married women of reproductive age in Bangladesh (n=17863)

Characteristics	Moderate Knowledge		High Knowledge	
	COR (95% CI)	p-value	COR (95% CI)	p-value
Age of respondent				
15-24 years	Ref.		Ref.	
25-34 years	0.96 (0.86, 1.08)	0.490	0.93 (0.83, 1.04)	0.191
≥ 35 years	0.56 (0.50, 0.63)	<0.001	0.48 (0.42, 0.55)	<0.001
Place of residence				
Rural	Ref.		Ref.	
Urban	2.37 (1.95, 2.87)	<0.001	3.42 (2.80, 4.18)	<0.001
Administrative division				
Barisal	Ref.		Ref.	
Chittagong	0.82 (0.55, 1.22)	0.327	0.97 (0.56, 1.66)	0.910
Dhaka	0.99 (0.67, 1.47)	0.963	1.24 (0.75, 2.05)	0.405
Khulna	1.24 (1.04, 1.39)	0.013	1.41 (0.86, 2.31)	0.174
Rajshahi	0.67 (0.87, 1.77)	0.038	0.75 (0.45, 1.25)	0.268
Rangpur	0.62 (0.41, 0.93)	0.020	0.65 (0.39, 1.07)	0.089
Sylhet	0.56 (0.36, 0.88)	0.012	0.49 (0.29, 0.85)	0.011
Wealth Quintile				
Poorest	Ref.		Ref.	
Poorer	1.71 (1.47, 2.00)	<0.001	1.69 (1.39, 2.05)	<0.001
Middle	3.11 (2.60, 3.73)	<0.001	3.36 (2.76, 4.08)	<0.001
Richer	4.91 (3.98, 6.07)	<0.001	6.24 (5.00, 7.78)	<0.001
Richest	10.60 (8.41, 13.36)	<0.001	18.23 (14.05, 23.66)	<0.001
Respondent's education				
None	Ref.		Ref.	
Primary	2.55 (2.24, 2.89)	<0.001	2.49 (1.95, 3.18)	<0.001
Secondary or higher	8.82 (7.66, 10.16)	<0.001	14.48 (11.50, 18.23)	<0.001
Respondent's current employment status				
Unemployed	Ref.		Ref.	
Employed	0.83 (0.73, 0.93)	0.002	0.81 (0.72, 0.92)	0.001
Age at first marriage				
<15 years	Ref.		Ref.	
15-19 years	1.42 (1.24, 1.63)	<0.001	1.72 (1.52, 1.95)	<0.001
≥20 years	2.84 (2.22, 3.64)	<0.001	4.86 (3.85, 6.13)	<0.001
Media exposure				
No	Ref.		Ref.	
Yes	4.79 (4.21, 5.45)	<0.001	7.03 (6.03, 8.20)	<0.001

HIV/AIDS knowledge between rural (27.9%) and urban (45.2%) women.

To see the association of knowledge level with the sample characteristics, we did bivariate analysis, the results of which are shown in Table 2. There was a gradual increase in the proportion of participants possessing high-level HIV-related knowledge, proportionate to the level of education, ranging

from 15.4% among illiterate participants to 47.4% among participants with secondary or higher education. HIV knowledge was lower among women in the rural areas (27.9%) and among the poorest women (17.1%). Higher prevalence (55.1%) of HIV knowledge was observed among participants whose partners used condoms as a contraceptive method than those who did not use condoms.

Supplementary Table 3. Adjusted Incidence Rate Ratio of knowledge level regarding HIV/AIDS among ever-married women of reproductive age in Bangladesh (Sensitivity Analysis) (n=17863)

Characteristics	AIRR (95 % CI)	p-value
Age of respondent		
15-24 years	Ref.	
25-34 years	1.06 (1.02, 1.10)	0.005
≥ 34 years	0.97 (0.92, 1.02)	0.229
Type of place of residence		
Urban	Ref.	
Rural	1.13 (1.07, 1.19)	<0.001
Administrative division		
Barisal	Ref.	
Chittagong	0.87 (0.78, 0.97)	0.016
Dhaka	1.02 (0.93, 1.11)	0.673
Khulna	1.12 (1.03, 1.22)	0.010
Rajshahi	0.88 (0.80, 0.98)	0.015
Rangpur	0.93 (0.83, 1.05)	0.251
Sylhet	0.84 (0.73, 0.96)	0.013
Wealth Quintile		
Poorest	Ref.	
Poorer	1.14 (1.05, 1.24)	0.002
Middle	1.26 (1.16, 1.36)	<0.001
Richer	1.34 (1.22, 1.47)	<0.001
Richest	1.37 (1.25, 1.51)	<0.001
Respondent's education		
None	Ref.	
Primary	1.52 (1.38, 1.66)	<0.001
Secondary or higher	2.04 (1.87, 2.23)	<0.001
Respondent's employment status		
Unemployed	Ref.	
Employed	1.04 (0.99, 1.09)	0.124
Age at first marriage		
<15 years	Ref.	
15-19 years	1.03 (0.99, 1.08)	0.191
≥20 years	1.05 (0.99, 1.11)	0.055
Media exposure		
No	Ref.	
Yes	1.46 (1.38, 1.54)	<0.001

Variables that were significantly associated with HIV/AIDS knowledge level in bivariate analysis were included in the multiple multinomial logistic regression model.

Results of multiple multinomial logistic regression analysis performed for identifying factors associated with HIV/AIDS knowledge level of

Table 1. Background characteristics of the ever-married women aged 15-49 years in BDHS 2014 (n=17863)

Characteristics	percentage	frequency
Age of respondent		
15-24 years	29.4	5184
25-34 years	36.0	6355
≥35 years	34.6	6324
Place of residence		
Urban	28.3	6167
Rural	71.7	11696
Administrative division		
Barisal	6.2	2142
Chittagong	18.5	2865
Dhaka	34.8	3093
Khulna	10.3	2581
Rajshahi	11.8	2512
Rangpur	11.5	2531
Sylhet	6.9	2139
Wealth quintile		
Poorest	18.8	3251
Poorer	19.1	3360
Middle	19.9	3621
Richer	21.0	3769
Richest	21.2	3862
Respondent's education		
None	24.9	4206
Primary	29.2	5226
Secondary or Higher	45.9	8431
Respondent's current employment status		
Unemployed	66.9	12239
Employed	33.1	5624
Age at first marriage		
<15 years	36.2	6373
15-19 years	54.7	9789
≥20 years	9.1	1701
Use of condom during sexual intercourse		
Not using	93.9	16754
Using	6.1	1109
Media exposure		
No	37.5	6593
Yes	62.5	11270

the respondents are presented in Table 3. In the adjusted model, women with age at first marriage between 15 and 19 years and 20 years or more had, respectively, 1.15 (95% CI 1.01, 1.30) and 1.70 (95% CI 1.37, 2.12) times higher likelihood

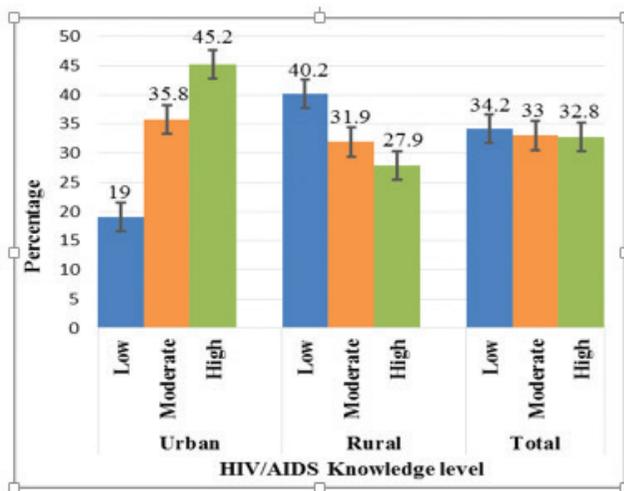


Figure 3. Percentage distribution of HIV/AIDS knowledge level (Scoring from 11 questions).

to have high knowledge regarding HIV/AIDS than the women who got married before the age of 15 years. Respondent's level of education was found to be strongly associated with the level of knowledge regarding HIV/AIDS ($p < 0.001$). For example, women who completed primary and secondary or higher education had, respectively, 2.16 (95% CI 1.63, 2.85) and 8.37 (95% CI 6.34, 11.03) times higher odds of having high HIV/AIDS knowledge compared to their illiterate counterparts. Women exposed to the media were, respectively, 2.44 (95% CI 2.15, 2.77) and 2.81 (95% CI 2.40, 3.29) times more likely to have moderate and high HIV/AIDS knowledge than women who were not exposed to media. Again, women living in urban area were, respectively, 1.24 (95% CI 1.06, 1.46) and 1.54 (95% CI 1.26, 1.87) times more likely to possess moderate and high HIV/AIDS knowledge than rural women. Women belonging to the middle, richer, and richest wealth quintiles had, respectively, 1.34 (95% CI 1.10, 1.63), 1.87 (95% CI 1.48, 2.36), and 3.03 (95% CI 2.27, 4.05) times higher odds of having high HIV/AIDS knowledge than women from the poorest wealth quintile. We also performed adjusted negative binomial regression by summing all the 11 questions for sensitivity analysis (taking outcome as count variable). Since mean knowledge score of HIV/AIDS significantly differed from variance (assumption violation of Poisson regression), we did negative binomial regression analysis and found similar associated factors of HIV/AIDS knowledge (Supplementary Table 2) to those which we found from multiple multinomial logistic regression.

Discussion

Although the prevalence of HIV/AIDS in Bangladesh is still low, the determinants of HIV/AIDS knowledge identified in this study need to be considered carefully to curb the HIV/AIDS burden. This study identified some significant socio-demographic, and background determinants of HIV/AIDS knowledge, including respondents' age at first marriage, education level, media exposure, place of residence, and wealth status, which calls for special attention from policy makers to create awareness among ever-married women of reproductive age in Bangladesh in order to prevent the burden.

Findings of our study showed women with a higher age at first marriage (≥ 20 years) had greater likelihood of having high HIV/AIDS knowledge compared to women who got married at earlier ages (< 15 years). This finding is consistent with the findings of a study conducted in Bangladesh by Laskar et al. [23]. This could be explained by the fact that early marriage hampers women's ability to complete their education, sometimes resulting in incomplete primary education which may deprive them of the opportunity to gain knowledge about health and common diseases. In addition, lack of maturity about sexuality and lack of understanding of sexually transmitted diseases (STDs) at an early age could be another reason for having less knowledge about HIV/AIDS [18,22]. There is a need for nationwide interventions for increasing the age at first marriage in Bangladesh since older age at first marriage not only increases the knowledge related to HIV/AIDS but also prevents reproductive health related complications among women.

Results of this study illustrated that women with the higher level of education had higher odds of having high HIV/AIDS related knowledge. This finding is supported by the evidence generated from other studies [26–27]. The justification is, education creates the opportunity for people to learn about different health related topics through formal learning environment. Moreover, besides achieving academic knowledge, education enables one to achieve knowledge from external sources beyond the classroom such as group meetings, seminars, symposiums and conferences. To increase HIV/AIDS knowledge, we recommend including more HIV/AIDS and other STD related topics in the national curriculum.

Women's exposure to mass media plays an important role in increasing their awareness about

Table 2. Association of knowledge level with sample characteristics (n=17863)

Characteristics	Low, % (n)	Moderate, % (n)	High, % (n)	Mean (SD)	p-value
Age of respondent					
15-24 years	28.6 (1476)	34.8 (1841)	36.6 (1867)	5.9 (3.9)	<0.001
25-34 years	29.8 (1802)	34.8 (2263)	35.4 (2290)	6.0 (3.9)	
≥35 years	43.5 (2679)	29.6 (1909)	26.9 (1736)	4.7 (4.1)	
Place of residence					
Urban	19.0 (1261)	35.8 (2206)	45.2 (2700)	6.7 (3.6)	
Rural	40.2 (4696)	31.9 (3807)	27.9 (3193)	4.8 (4.1)	
Administrative division					
Barisal	31.8 (646)	36.5 (822)	31.6 (674)	5.6 (3.8)	<0.001
Chittagong	34.5 (925)	32.4 (988)	33.2 (952)	5.6 (4.0)	
Dhaka	29.7 (817)	33.8 (1100)	36.5 (1176)	6.2 (3.8)	
Khulna	26.2 (622)	37.3 (951)	36.6 (1008)	6.3 (3.7)	
Rajshahi	39.7 (912)	30.7 (776)	29.6 (824)	5.3 (4.1)	
Rangpur	42.6 (1084)	30.1 (714)	27.3 (733)	4.8 (4.2)	
Sylhet	46.8 (951)	30.3 (662)	23.0 (526)	4.5 (4.1)	
Wealth Quintile					
Poorest	61.3 (1982)	21.6 (734)	17.1 (535)	3.1 (3.9)	<0.001
Poorer	48.3 (1594)	29.1 (1016)	22.6 (750)	4.2 (4.0)	
Middle	33.0 (1179)	36.2 (1333)	30.9 (1109)	5.5 (3.9)	
Richer	22.4 (817)	38.7 (1450)	38.9 (1502)	6.5 (3.6)	
Richest	10.2 (385)	38.1 (1480)	51.7 (1997)	7.7 (2.9)	
Respondent's education					
None	63.9 (2691)	20.8 (912)	15.4 (603)	2.9 (3.8)	<0.001
Primary	41.2 (2142)	34.1 (1816)	24.7 (1268)	4.7 (4.0)	
Secondary or higher	13.6 (1124)	39.0 (3285)	47.4 (4022)	7.3 (3.1)	
Respondent's current employment status					
Unemployed	32.7 (3957)	33.7 (4177)	33.6 (4105)	5.6 (4.0)	<0.001
Employed	37.2 (2000)	31.7 (1836)	31.1 (1788)	5.3 (4.1)	
Age at first marriage					
<15 years	42.2 (2644)	31.5 (2049)	26.4 (1680)	4.7 (4.1)	<0.001
15-19 years	31.9 (3057)	33.8 (3360)	34.3 (3372)	5.7 (4.0)	
≥20 years	16.2 (256)	34.5 (604)	49.3 (841)	7.3 (3.3)	
Media Exposure					
No	58.4 (3793)	23.9 (1667)	17.7 (1133)	3.4 (3.9)	<0.001
Yes	19.7 (2164)	38.5 (4346)	41.9 (4760)	6.7 (3.5)	
Use of condom during sexual intercourse					
Not using	35.7 (5842)	33.0 (5619)	31.4 (5293)	5.4 (4.0)	<0.001
Using	11.4 (115)	33.5 (594)	55.1 (600)	7.8 (3.0)	
Total	34.2 (5957)	33.0 (6013)	32.8 (5893)	5.5 (4.0)	

HIV/AIDS in Bangladesh [24]. Like previous studies [22,28–29], our study findings substantiated that women exposed to any kind of print or electronic media had a higher likelihood of possessing moderate-to-high knowledge about HIV and

AIDS. The plausible explanation of this finding is that newspaper, radio, and television disseminate information about the causes, consequences and prevention of various diseases including STIs. Thus, access to these media ensures women's access to

Table 3. Adjusted odds ratio of knowledge level regarding HIV/AIDS among ever-married women of reproductive age in Bangladesh (n=17863)

Characteristics	Moderate Knowledge		High Knowledge	
	AOR (95 % CI)	p-value	AOR (95% CI)	p-value
Age of respondent				
15-24 years	Ref.		Ref.	
25-34 years	1.37 (1.19, 1.57)	<0.001	1.34 (1.16, 1.56)	<0.001
≥ 35 years	1.09 (0.95, 1.27)	0.220	1.05 (0.89, 1.23)	0.568
Place of residence				
Rural	Ref.		Ref.	
Urban	1.24 (1.06, 1.46)	0.008	1.54 (1.26, 1.87)	<0.001
Administrative division				
Barisal	Ref.		Ref.	
Chittagong	0.54 (0.40, 0.72)	<0.001	0.58 (0.41, 0.84)	0.004
Dhaka	0.81 (0.62, 1.06)	0.117	0.94 (0.69, 1.28)	0.679
Khulna	1.13 (0.87, 1.47)	0.360	1.29 (0.94, 1.78)	0.120
Rajshahi	0.58 (0.44, 0.78)	<0.001	0.65 (0.46, 0.92)	0.014
Rangpur	0.64 (0.45, 0.90)	0.011	0.69 (0.48, 0.98)	0.040
Sylhet	0.61 (0.44, 0.86)	0.004	0.54 (0.36, 0.80)	0.002
Wealth Quintile				
Poorest	Ref.		Ref.	
Poorer	1.27 (1.08, 1.49)	0.004	1.16 (0.96, 1.41)	0.128
Middle	1.50 (1.26, 1.78)	<0.001	1.34 (1.10, 1.63)	0.003
Richer	1.92 (1.54, 2.39)	<0.001	1.87 (1.48, 2.36)	<0.001
Richest	2.70 (2.11, 3.46)	<0.001	3.03 (2.27, 4.05)	<0.001
Respondent's education				
None	Ref.		Ref.	
Primary	2.24 (1.95, 2.57)	<0.001	2.16 (1.63, 2.85)	<0.001
Secondary or higher	5.72 (4.96, 6.60)	<0.001	8.37 (6.34, 11.03)	<0.001
Respondent's current employment status				
Unemployed	Ref.		Ref.	
Employed	1.08 (0.95, 1.24)	0.246	1.16 (1.01, 1.35)	0.042
Age at first marriage				
<15 years	Ref.		Ref.	
15-19 years	1.04 (0.92, 1.17)	0.495	1.15 (1.01, 1.30)	0.028
≥20 years	1.27 (1.02, 1.59)	0.034	1.70 (1.37, 2.12)	<0.001
Media exposure				
No	Ref.		Ref.	
Yes	2.44 (2.15, 2.77)	<0.001	2.81 (2.40, 3.29)	<0.001

information about the HIV/AIDS burden, transmission, and its prevention. Place of residence is one of the factors that can influence people's access to basic rights including education and health. Evidence suggests that urban people are more likely to have access to better education and healthcare compared to their rural counterparts, which can have an impact on their lifestyles and cultural practices

[30]. Similar studies conducted in Bangladesh and other countries have also corroborated the differences in knowledge level of HIV and AIDS between these two settings [18,22,31]. For instance, a study by Mondal et al. [29] posited that rural women were less likely to be knowledgeable about HIV/AIDS than urban women. Again, women from the richer and richest households were more likely to

have high knowledge of HIV/AIDS than the women from the poorest households, which corresponds with the finding of Sheikh et al. [22]. Better socio-economic status improves people's access to education and health care, which in turn can contribute to increased awareness about diseases and health problems. There were also variations in knowledge levels observed among women living in different administrative divisions in Bangladesh. Women living in Chittagong, Rajshahi, Rangpur, and Sylhet divisions had lower knowledge level compared to Barisal division. This indicates the unequal coverage of awareness building programs on HIV/AIDS and a need to prioritize these divisions during planning and implementation of such programs.

Based on the determinants identified in this study, we recommend the extension of information coverage through mass media. For example, regular broadcasting of television and radio commercials, public service announcements, news reports, dramas, discussion and talk shows, newspaper articles etc. can be effective in creating mass awareness about HIV/AIDS, even in the hard-to-reach areas [32,33]. Interventions targeted at improving women's health should incorporate the strategies to disseminate messages relating to HIV/AIDS, the disadvantages of early marriage, mother-to-child transmission of HIV/AIDS, the practice of safe sex, and the benefits of using condoms through mass media or school curriculum.

Limitations

Like other studies, this study has some limitations. First, being a cross sectional study, we cannot determine the causative relationships between the determinants of HIV/AIDS knowledge. Second, the study population belongs to the reproductive age group but women below 15 and over 49 years old may also be susceptible to HIV/AIDS even though they are considered infertile at this age. Third, slum dwellers, street-based floaters, nomadic people, and people moving across the border areas are mostly affected by HIV/AIDS but the sampling strategy of BDHS does not take into account these specific populations. Special studies can be conducted to capture these cohorts of people in examining their knowledge related to HIV/AIDS. However, the wide range of study domain may allow BDHS 2014 to capture respondents from diverse cohort. Statistical association drawn from large scale cross-sectional survey is very common. Despite the limitations, our results provide an important contribution in

the literature in assessing the association between socio-demographic variables and HIV/AIDS knowledge among Bangladeshi reproductive women.

Conclusion

Overall, a major portion of the reproductive women did not have adequate knowledge on HIV/AIDS in Bangladesh. A number of demographic and socio-economic factors, such as early first marriage, education, absence of media exposure, rural residence, wealth index, and administrative division significantly predicted the HIV/AIDS knowledge level among ever-married women of reproductive age in Bangladesh. Protecting women against getting married early, increasing their access to mass media, and enhancing outreach activities related to HIV/AIDS knowledge to geographically marginalized women may increase awareness about HIV/AIDS knowledge and protect them from contracting this life threatening disease. Government, non-governmental organizations, program organizers, policy makers, and healthcare professionals should work together to intensify the existing awareness raising strategies, and plan and facilitate more educational interventions for increasing ever-married women's knowledge level about HIV/AIDS, as well as implementing awareness raising activities for the general population as per the guidance of 4th National Strategic Plan for HIV and AIDS response (2018–2022), thus mitigating the looming threat of an HIV/AIDS epidemic.

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Competing interest

None declared.

Ethical approval

In this study, we used de-identified BDHS 2014 data obtained from MEASURE DHS. Ethical approval was not necessary, as the study was conducted on anonymous public use data having no identifiable information on the survey respondents.

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