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Prevalence and factors associated with knowledge of HIV Self-Test kit and HIV-Self Testing among Ghanaian women: multi-level analyses using the 2022 Ghana demographic and health survey

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Abstract

Background The Ghana AIDS Commission reported in 2022 that out of 354,927 people living with HIV, 67.5% were females. While considerable progress has been made in expanding access to HIV testing services, a significant proportion of individuals remain unaware of their HIV status, presenting a significant barrier to effective prevention and treatment. Although HIV Self-Testing (HIVST) has emerged as a promising approach to increase the uptake of HIV testing, its adoption and utilisation have been limited by various sociodemographic factors. We investigated the knowledge of HIV Self-Testing Kit as well as prevalence of HIVST and their associated factors among Ghanaian women.

Methods This was a cross-sectional study among 15,014 women of their reproductive age using data from the 2022 GDHS. The data were analysed using STATA version 17.0. Simple frequencies were used to summarise the data. A multilevel binary logistic regression using four models (Models I–IV) was used to examine the association between the two outcome variables and the explanatory variables, controlling for individual- and contextual-level factors. Statistical significance was set at $p < 0.05$ at 95% CI.

Results We discovered that only 18.2% [95% CI = 17.1–19.3] and 2.4% [95% CI = 2.1–2.8] of Ghanaian women in their reproductive age had adequate knowledge of HIV Self-Testing Kit (HIVSTK) and had used the HIVSTK for HIV testing respectively. The odds of knowledge of HIVSTK were higher among women aged 20–24 years (aOR = 1.33, 95% CI = 1.07, 1.64; $p = < 0.01$), those with a higher level of education (aOR = 6.14, 95% CI = 4.41, 8.55; $p < 0.001$), those who listen to radio (aOR = 1.41, 95% CI = 1.20, 1.65; $p < 0.001$) and use the internet at least once a week (aOR = 1.49, 95% CI = 1.24, 1.78; $p < 0.001$). The odds of knowing about HIVSTKs increased with higher levels of wealth distribution with the highest recorded among those in the wealthiest group (aOR = 1.85, 95% CI = 1.32, 2.58; $p < 0.001$). Compared with women with no formal education, the odds of HIVST were higher among those with higher education (aOR = 20.29, 95% CI = 9.16, 44.97; $p < 0.001$). The odds of HIVST were also higher among those who listen to radio (aOR = 1.51, 95% CI = 1.05, 2.17; $p < 0.05$) and those who use the internet at least once a week [aOR = 1.80, 95% CI = 1.15, 2.83; $p < 0.001$). Furthermore, the odds of self-testing for HIV were higher among women with a history

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of HIVST (aOR = 6.73, 95% CI = 3.34, 13.55; $p = < 0.001$) and those with the wealthiest wealth quintiles (aOR = 4.31, 95% CI = 1.31, 13.02; $p = < 0.001$).

Conclusion Our study revealed a shallow knowledge of HIV Self-Testing Kit as well as a low prevalence of HIV self-testing among women in their reproductive age in Ghana. The evidence suggests that more than nine in ten women had never undertaken an HIV self-test. The observed HIVST in this study may have implications for achieving the objectives of the HIVST policy. This may impede the achievement of SDG 3.3 which seeks to end the AIDS epidemic by 2030. Practical strategies including education and awareness, may be utilized through electronic media as well as radio and television, especially among those with little or no education. Additionally, the government can subsidise testing kits to create opportunities for those in the low-wealth quintiles to purchase and self-test themselves.

Keywords HIV Self Testing, Knowledge of HIV Self-Test kit, Women, Reproductive age, Ghana

Background

Human Immunodeficiency Virus (HIV) continues to be a significant public health challenge globally [1, 2]. The burden of HIV currently stands at about 39.9 million people worldwide, with women accounting for 53% of this population [3]. Despite efforts to combat the HIV epidemic, there has been little progress in reducing the gender disparity in HIV infections over recent years [3]. This disparity is particularly pronounced in Sub-Saharan Africa, which bears a disproportionate burden of the global HIV epidemic. This region not only exhibits significant variation in HIV prevalence and incidence rates across the population but is also characterised by a disproportionate impact on women, especially those of lower socioeconomic status, who face a (69%) higher risk of infection [4, 5].

In 2022, the Ghana AIDS Commission (GAC) reported that out of 354,927 people living with HIV (PLHIV), 67.5% were females [6]. This disparity in HIV prevalence among Ghanaian women can be linked to several factors including poverty, limited access to education and the healthcare system, persisting gender inequality, and cultural norms that perpetuate stigma and discrimination surrounding HIV [7]. Despite ongoing challenges, Ghana has made considerable progress in scaling up HIV testing, a critical aspect of achieving the UNAIDS 95–95-95 targets [8]. The ambitious treatment target by the UNAIDS known as "Project 95–95-95, aims to achieve 95% of people living with HIV knowing their status, 95% of diagnosed individuals on antiretroviral therapy (ART), and 95% of those on ART achieving viral suppression by 2025" [3]. In recent years, the country has introduced innovative testing approaches such as community-based testing, mobile testing units, and, more recently, HIV self-testing (HIVST). These efforts have been aimed at reaching populations who face barriers to accessing traditional healthcare settings. Community-based testing and mobile units were introduced in 2016, following the adoption of the WHO's Differentiated Service Delivery (DSD) model, which enhanced testing coverage and improved linkage to care [9–13]. In June 2022, Ghana officially launched an HIV self-testing programme, allowing individuals to confidentially and conveniently assess their status at home. This initiative has further expanded testing options, increasing case detection and moving the country closer to achieving the 95–95-95 targets [14]. These efforts have helped the country inch towards achieving the ambitious 95–95-95 treatment targets particularly the first goal of ensuring 95% of all people living with HIV know their status [3]. As of 2022, approximately 72% of PLHIV in Ghana are aware of their HIV status [14]. This awareness is significantly higher among women, largely due to the inclusion of routine HIV testing in existing healthcare such as antenatal care [15, 16]. Despite this, only 31.4% of women have been tested recently, revealing a gap in reaching the first 95 target [17].

While considerable progress has been made in expanding access to HIV testing services, a significant proportion of individuals remain unaware of their HIV status, presenting a significant barrier to effective prevention and treatment [2, 18, 19]. A 2021 Ghanaian study, for instance, demonstrated that only 13% of women in Ghana had tested for HIV in the 12 months preceding the survey [19]. The disparity between men and women in HIV testing rates highlights the importance of further research on women's knowledge of and access to HIV self-testing. Women of lower socioeconomic status continue to face barriers in accessing testing services, contributing to the persistently high rates of HIV infection in this group [4]. Understanding these factors is critical for addressing the gender disparity and supporting Ghana's achievement of the 95–95-95 goals.

HIVST has emerged as a promising approach to increase the uptake of HIV testing, particularly among populations with limited access to traditional facility-based services [20–22]. It is an innovative approach that allows individuals to collect their specimens and

perform and interpret the result in private or with someone they trust using a rapid diagnostic test [23–25]. This method has been recognised by WHO to increase the uptake and frequency of HIV testing, particularly among populations that may not otherwise seek testing due to stigma, privacy concerns, or other barriers [25]. Multiple studies have observed that HIV self-testing and using HIVSTK is accurate, easy to use, and well-received by people in many situations [26–28]. These modalities have expanded access to HIV testing, particularly among risk underserved populations [29, 30]. Brown et al. [31] and Qin et al. [32] mentioned that it also avoids many of the problems people face with standard testing, like long waits, inconvenient hours, fear of judgment, and privacy concerns by offering a private, convenient, and empowering way to get tested for HIV. However, the success of HIVST interventions depends on factors such as knowledge, acceptance, and sociodemographic characteristics of users [7]. Studies have shown that age, education, urban residence, wealth, media exposure, and comprehensive HIV knowledge are associated with higher use of HIVSTK and HIVST uptake [33–35]. In Ghana, HIV testing among young women has increased to 31.4% [36]. The overall prevalence remains 2.5% for women aged 15–49 [17]. Despite the high level of knowledge (81.9%), positive attitudes towards HIV testing remain low (10.5%) among women [37].

Several factors including older age, higher education, wealth, media exposure and comprehensive HIVST knowledge influence the uptake of HIV Testing services. Socioeconomic status (SES) is a multifaceted concept encompassing a person's wealth status, education, occupation, and social standing and is a critical determinant of knowing HIVST [7, 19, 38]. Women from lower socioeconomic backgrounds, for instance, have poorer HIV-related knowledge and more negative attitudes towards people living with HIV/AIDS which may likely not translate into self-testing using the test kits compared to those from higher SES backgrounds [19]. Study by Abokyi et al. [39] revealed that rural residents often express a higher willingness to undergo HIV testing services than urban dwellers. However, rural areas face significant challenges including higher HIV prevalence, lower education levels, and limited access to testing services [40]. Terefe et al. revealed that the more people watch and read news about HIV, the more likely they are to know about and use HIV Self-tests [41]. Social media-based interventions have proven effective in increasing the demand and use of these kits, especially among populations stigmatised by HIV [42, 43].

Previous studies have shown that individuals with higher levels of education about HIVSTK tend to have better knowledge and understanding of HIV transmission and prevention as well as increased awareness of available testing services [8, 19, 44]. Worku et al. [34] noted that education enhances an individual's ability to access and comprehend health-related information, empowering them to make informed decisions to self-test improving their well-being. The impact of education on HIV knowledge and HIVST aligns with and will help achieve SDG target 4.1 which aims to ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy by 2030 [45].

Wealth status, often measured by the wealth index, is also another critically important factor that influences access to and utilisation of HIV testing services, including HIVST. Research shows that individuals from wealthier backgrounds may have more significant financial resources and better access to healthcare services, increasing the likelihood of self-testing or boosting the knowledge about the use of HIVSTK [7, 34, 44]. Conversely, those from lower socioeconomic groups may face barriers such as limited affordability, rural residence, and reduced access to information and resources [8, 44]. This highlights the importance of achieving SDG 1, which aims to end poverty in all forms everywhere. Poverty is a critical driver of health disparities, including HIV, and addressing it can reduce these barriers and improve access to HIV prevention and care services. Alderman et al. [46] study indicated that poverty reduction initiatives, such as social protection programmes, can positively impact health by promoting greater access to healthcare services and yielding improved health outcomes, including decreased HIV prevalence [46]. Specifically, target 1.3, focuses on implementing nationally appropriate social protection systems which can improve healthcare access for vulnerable populations by reducing financial and social barriers. Achieving these targets would contribute to reducing HIV incidence, as improved social protection systems can enhance access to HIV testing, including self-testing, and ultimately support progress toward the UNAIDS 95–95-95 targets [45]. Stoner et al. [47] demonstrated that cash transfer programs and other poverty alleviation measures reduce risky sexual behaviour and increase engagement with HIV services.

While higher education is linked to increased HIV testing and knowledge about HIVSTK, existing studies of HIVST among Ghanaian women have been limited geographically [26, 29]. This study aims to address this knowledge gap by conducting a nationally representative study into the potential prevalence among Ghanaian women. The study will examine the influence of individual factors such as age, education, marital status, and socioeconomic status on HIVSTK knowledge and subsequent HIVST uptake using nationally representative

demographic and health survey data. The findings could also inform policies aimed at improving HIVST rates, which will contribute to reducing the burden of HIV/AIDS in Ghana, thereby, aligning with SDG 3, which seeks to achieve good health and well-being [45]. We adopted the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines in conducting and reporting this study [48].

Materials and methods

Data source and study design

We analysed data from Ghana's Demographic and Health Survey (GDHS) conducted in 2022. The dataset is freely available to download at https://dhsprogram.com/data/available-datasets.cfm. The Demographic and Health Survey (DHS) is a comparable nationally representative survey undertaken regularly in over 90 countries, enhancing a global understanding of developing country health and demographic trends. DHS employed a cross-sectional design to collect data from the respondents: men and women. Structured questionnaires were used to collect data on several health and social indicators from the respondents. The female dataset file (IR) was used for this study. The DHS utilised a two-stage cluster sampling method. First, a stratified sample of enumeration areas (EAs) was chosen using probability proportional to size (PPS). A listing technique was used in the designated EAs to ensure that all dwellings/households were listed. Second, households in the selected EAs were selected using equal probability systematic sampling. In this study, we included 15, 044 women in their reproductive age.

Study variables

Outcome variable

We used two outcome variables in this study. This includes the knowledge of HIV Self-Test Kit and Prevalence of HIV Self-Testing. The recoding of this variable was done based on the DHS statistics. Refer to this link to have access to the DHS statistics on the computation of this outcome variable (https://dhsprogram.com/data/Guide-to-DHS-Statistics/Self-Testing_for_HIV.htm?rhtocid=_16_15_0#Percentage_of_women_and12bc-1).

The variable used was coded "v856" in the dataset. It has these options (.=missing values(mv), 0=Never heard of HIV self-test kits, 1=has tested with HIV test kits and 2=knows test kits but never tested with them).

To obtain the knowledge of the HIV Self-Test Kit (HSTK), mv and one were recoded to "No/Does not know about HSTK" while codes 1 and 2 were recoded to "Yes/Knows about HSTK". It became a binary outcome (0=No and 1=Yes).

To also obtain the prevalence of HIV Self-Testing, codes 0, 2 and mv were recoded to "No/Never self-tested") and one was recoded to "Yes/Ever self-tested".

The justification for transforming the variable this came from the DHS statistics. Under the section of handling missing when creating this particular composite, it was mentioned that "Missing values on the question about knowledge of HIV self-test kits is assumed to represent a lack of knowledge and is excluded from the numerators but included in the denominator. If a "don't know" response is given to whether a test kit had been used (women: v856=3) it is assumed that a test kit has not been used."

Explanatory variables

The explanatory variables included in this study were based on the review of the literature and data availability [49–51]. These variables were further grouped into vital explanatory variables and covariates.

Explanatory variables A total of 13 variables were studied as covariates in the study. These variables were categorised into individual and contextual-level factors.

Individual-level factors Age (15–19, 20–24, 25–29, 30–34, 35–39, 40–44 and 45–49 years) religion (Christianity, Islam and No religion), marital status (never in union, married, cohabiting, widowed, divorced and separated), level of education (no formal education, primary, secondary and higher), current working status (working and not working), religion (Christians, Muslims and traditionalists/none/others) and history of HIV testing (No and Yes) were considered as the individual-level factors. Reading a newspaper (No and Yes), listening to radio (No and Yes), watching television (No and Yes) and usage of internet (No and Yes) were also added. However, these variables came naturally with these categories ('not at all', 'less than once a week', 'at least once a week' & 'almost every day'), but, they were dichotomized in No and Yes such that 'No' (Not at all and less than once a week) and 'Yes' (at least once a week and almost every day). Regarding religion, 'catholic, anglican, Methodist, Presbyterian, Pentecostal and others Christian denominations' were grouped as Christians. Traditionalist, no religion and others were also grouped as one whilst Islam remained as such.

Contextual-level factors The contextual variables were wealth index, place of residence and regions. From the DHS, the place of residence was coded as 'urban' and 'rural' whereas the wealth index was coded as 'poorest', 'poorer', 'middle', 'richer' and 'richest'. The final contextual variable used was the region (16 regions). For all the

contextual variables, no transformation was done. Variables were used as coded in the DHS.

Data analysis

Data analyses for this study were conducted using STATA version 17. To begin with, frequencies and percentages show the proportion of women who know about the HIV Self-Test kit as well as those who tested for HIV using the self-test kit. After that, we performed cross-tabulation to determine the distribution of each outcome variable (Knowledge of HIV Self-Test kit and HIV Self Testing) by the explanatory variables. This was done using Pearson's chi-square test of independence ($\chi 2$) at a p-value of less than 0.05 to show significant variables associated with each outcome measure. Variables that were significant at were placed into the binary logistic regression model. A multilevel binary logistic regression using four models (Models I–IV) was used to examine the association between explanatory variables and the two outcomes each, controlling for individual- and contextual-level factors. A multilevel binary logistic regression was used because DHS survey comes with a hierarchical structure. Therefore, the analysis accounts for clustering, corrects biased standard errors, captures between-cluster variability, and provides more accurate estimates for both individual and cluster-level predictors.

Model I showed the variance in HST attributed to the clustering of the primary sampling units (PSUs) without the explanatory variable. Model II was fitted to contain the individual-level factors. Model III contained the contextual-level factors. Model IV was finally fitted to comprise individual- and contextual-level factors. The Stata command 'melogit' was used in fitting the five models. Fixed and random effects were included in all four models. The fixed effects represented the relationship between the explanatory variable and, covariates and the outcome variable. In contrast, the random effects represented the measure of variation in the outcome variable based on PSU, as measured by intracluster correlation (ICC). As a result, the ICC was used to quantify the differences between clusters in the sample used for the analysis. All the regression results were presented using adjusted ORs (aORs) at a 95% CI. The women's sample weight (v005/1,000,000) was applied to the data to cater to the complex survey design of the DHS dataset. The Stata command 'svy' was used to adjust for the disproportionate sampling and non-response and to improve the generalizability of the findings.

Ethical approval

For this study, ethical clearance was not applicable. This is because the DHS dataset is freely available in the public domain. Before the commencement of this study, permission to use the dataset was sought from the Monitoring and Evaluation to Assess and Use Results Demographic and Health Surveys (MEASUREDHS).

Results

Background characteristics

The background characteristics of Ghanaian women are presented in Table 1. The results show that 18% of Ghanaian women are aged 20–24 with nearly 60% attaining secondary level of education. Exactly two-fifths (40.0%) of the women are married and most (76.8%) of them identified as Christians. A large (74.6%) proportion of them are currently working, yet 38.2% of them use the internet at least once a week. Majority (84.9%) of the women are sexually active, but 57.3% have ever tested for HIV. More than half (57.0%) reside in the urban areas yet less than one-fourth (22.4%) belong to the wealthiest income quintile.

Knowledge about HIV Self-Test Kit among Ghanaian women

The knowledge about the HIV Self-Test Kit among Ghanaian women is such that 18.2% [95% CI = 17.1, 19.3] of them know about the HIV Self-Test Kit (HSTK), whilst 81.8% [95% CI = 80.7–82.9] do not know about HSTK (Fig. 1).

Prevalence of HIV Self-Testing among Ghanaian women

Results regarding the prevalence of HIV Self-Testing among Ghanaian women show that only 2.4% [95% CI = 2.1–2.8] of them have ever self-tested for HIV whereas the remaining 97.6% [95% CI = 97.2–97.9] have never self-tested for HIV (Fig. 1).

Bivariate analysis between factors associated with knowledge of HIV Self-Test kits among Ghanaian women of reproductive age

The bivariate analysis between factors associated with knowledge of HIV Test-kits among Ghanaian women of reproductive age is shown in Table 2. The results revealed that age of the women ($\chi\ 2 = 18.64,\ p < 0.001$), level of education ($\chi\ 2 = 327.76,\ p < 0.001$), marital status ($\chi\ 2 = 8.81,\ p < 0.001$), religion ($\chi\ 2 = 10.62,\ p < 0.001$), working status ($\chi\ 2 = 6.15,\ p = 0.013$), reading newspaper once a week ($\chi\ 2 = 50.75,\ p < 0.001$), watching television once a week ($\chi\ 2 = 94.09,\ p < 0.001$), listening to radio once a week ($\chi\ 2 = 39.12,\ p < 0.001$), usage of internet ($\chi\ 2 = 313.98,\ p < 0.001$), testing history of HIV ($\chi\ 2 = 128.12,\ p < 0.001$), wealth index ($\chi\ 2 = 95.64,\ p < 0.001$), place of residence ($\chi\ 2 = 85.69,\ p < 0.001$) and region of the women ($\chi\ 2 = 5.41,\ p < 0.001$) were significantly associated with the women's knowledge of HIV Self- Test kit.

Table 1 Background characteristics of Ghanaian women

Variable	Weighted *N*=15,014	Weighted percentage (%)
Age of the women		
15-19	2682	17.8
20-24	2694	18.0
25-29	2339	15.6
30-34	2252	15.0
35-39	2058	13.7
40-44	1675	11.2
45-49	1312	8.7
Level of education		
No formal education	2411	16.1
Primary	2071	13.8
Secondary	8999	59.9
Higher	1533	10.2
Marital status		
Never in union	5267	35.2
Married	6008	40.0
Cohabiting	2197	14.6
Divorced	389	2.6
Widowed	367	2.4
Separated	786	5.2
Religion		
Christians	11531	76.8
Muslims	2906	19.4
Traditionalist/none/other	577	3.8
Current working status		
Not working	3808	25.4
Working	11205	74.6
Reads a newspaper at least once a week		
No	14475	96.4
Yes	539	3.6
Watches television at least once a week		
No	5768	38.4
Yes	9246	61.6
Listens to radio at least once a week		
No	8667	57.7
Yes	6347	42.3
Use the internet at least once a week		
No	9275	61.8
Yes	5739	38.2
Ever had sex		
No	2261	15.1
Yes	12753	84.9
Ever tested for HIV		
No	6403	42.7
Yes	8611	57.3
Place of residence		
Urban	8557	57.0
Rural	6456	43.0
Wealth index		
Poorest	2447	16.3
Poorer	2712	18.1
Middle	3121	20.7
Richer	3379	22.5
Richest	3355	22.4
Region		
Western	955	6.4
Central	1702	11.3
Greater Accra	2327	15.5
Volta	713	4.8
Eastern	1220	8.1
Ashanti	2928	19.5
Western North	411	2.7
Ahafo	317	2.1
Bono	567	3.8
Bono East	676	4.5
Oti	403	2.7
Northern	1149	7.7
Savannah	319	2.1
North East	290	1.9
Upper East	640	4.3
Upper West	398	2.7

Bivariate analysis between factors associated with HIV Self-Testing among Ghanaian women of reproductive age

The Pearson chi-square test of independence between factors associated with knowledge of HIV Self-Test-kits among Ghanaian women of reproductive age is shown in Table 2. The results revealed that age of the women ($\chi\ 2 = 14.15,\ p < 0.001$), level of education ($\chi\ 2 = 393.42,\ p < 0.001$), marital status ($\chi\ 2 = 4.29,\ p < 0.001$), religion ($\chi\ 2 = 3.55,\ p = 0.029$), working status ($\chi\ 2 = 15.55,\ p < 0.001$), reading newspaper once a week ($\chi\ 2 = 42.32,\ p < 0.001$), watching television once a week ($\chi\ 2 = 19.49,\ p < 0.001$), listening to radio once a week ($\chi\ 2 = 18.79,\ p < 0.001$), usage of internet ($\chi\ 2 = 283.53,\ p < 0.001$), testing history of HIV ($\chi\ 2 = 122.31,\ p < 0.001$), wealth index ($\chi\ 2 = 76.49,\ p < 0.001$), place of residence ($\chi\ 2 = 32.04,\ p < 0.001$) and region of the women ($\chi\ 2 = 2.12,\ p < 0.001$) were significantly associated with HIV Self- Testing among Ghanaian women.

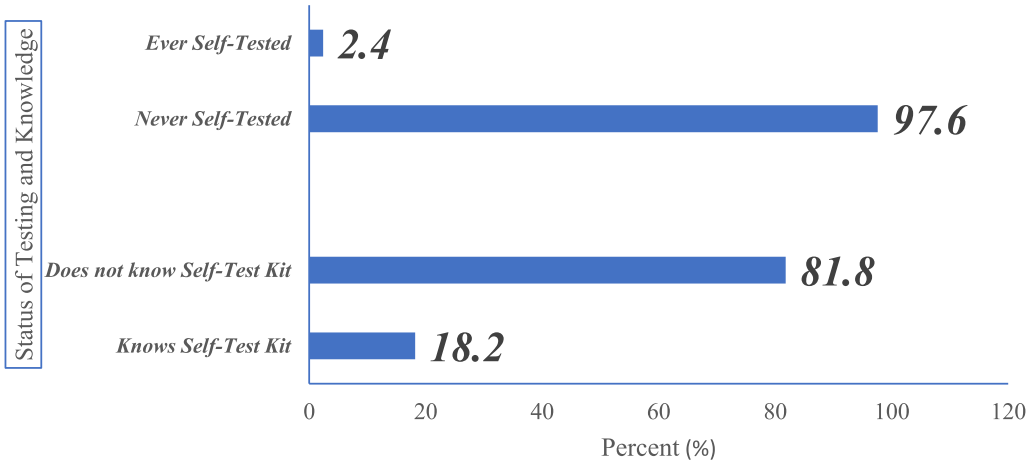

Fig. 1 Knowledge about HIV Self-Test Kit and prevalence of HIV Self-Testing among Ghanaian women

Fixed effects of the factors influencing Knowledge of HIV Self-Test-Kits among Ghanaian women

Model IV in Table 3 shows the factors influencing knowledge of HIV Self-Test kits among Ghanaian women. It contains both the individual and contextual level variables. The results revealed that women aged 20–24 years are 33% more likely to have knowledge of the HIVTSK as compared to those aged 15–19 [aOR = 1.33, 95% CI = 1.07, 1.64]. Furthermore, the odds of knowing about HIVTSK among married women are lower than those who are never in a union [aOR = 0.67, 95% CI = 0.54, 0.84]. Women with higher levels of education are six times more likely to know about HIVTSK than those without formal education (aOR= 6.14, 95% CI = 4.41, 8.55]. In addition, the odds of knowing about HIVTSK are higher among those who listen to radio [aOR = 1.41, 95% CI = 1.20, 1.65] and those who use the internet at least once a week [aOR = 1.49, 95% CI = 1.24, 1.78] compared to their counterparts who do not. Women who have ever tested for HIV have a higher likelihood of knowing about HIVTSK compared to those with no testing history [aOR = 1.84, 95% CI = 1.56, 2.18]. The odds of knowing about HTSK increased with higher levels of wealth distribution with the highest recorded among those in the wealthiest group [aOR = 1.85, 95% CI = 1.32, 2.58]. Finally, women from regions (Oti [aOR = 1.78, 95% CI = 1.28, 2.46] and Upper East [aOR = 1.68, 95% CI = 1.11–2.54] have higher odds of knowing about HIVTSK, but the lower odds of knowing about HTSK were recorded in Ashanti [aOR = 0.65, 95% CI = 0.47–0.92] and Savannah [aOR = 0.46, 95% CI = 0.25, 0.84] regions of Ghana compared to those in Greater Accra.

Random effects results of the factors influencing knowledge of HIV Test-Self Kit

Random effect results revealed a variation in the factors influencing knowledge of HIV Test-Self kit among Ghanaian women among the clusters ($\sigma 2 = 1.16$, 95% CI = 0.95,1.43). About 26% of the percentage of knowledge of the HIV Self-Test Kit was attributed to the variations between the clusters (intra-cluster correlation coefficient (ICC) = 0.26). This between-cluster difference reduced to 19% in Model II and a further decline to 18% in Model III. This difference was maintained at 18% in Model IV. These ICCs suggest that the likelihood of knowing about HIV Self-Test Kit variations can be attributed to the variances across the clusters.

Fixed effects of the factors influencing knowledge of HIV Test-Self Kit among Ghanaian women

Model IV in Table 4 shows factors influencing HIV Self-Testing (HTST) among Ghanaian women. It has both individual and contextual level variables. The results revealed that women with higher levels of education are more likely to self-test for HIV compared to those with no formal education (aOR = 20.29, 95% CI = 9.16, 44.97]. In addition, the odds of self-testing for HIV are higher among those who listen to the radio [aOR = 1.51, 95% CI = 1.05, 2.17] and those who use the internet at least once a week [aOR = 1.80, 95% CI = 1.15, 2.83] compared to their counterparts who do not. Women who have ever tested for HIV also have a higher likelihood of self-testing for HIV compared to those with no testing history [aOR = 6.73, 95% CI = 3.34, 13.55]. The odds of self-testing for HIV among women with the wealthiest quintiles is four times compared to those in the poorest category

Table 2 Pearson chi-square test of independence between factors associated with knowledge of HIV Self Test-kit and HIV Self-Testing among Ghanaian women of reproductive age

Variables	Know HIV Self-Test Kit		Ever Self-Tested for HIV	
	Yes	*χ 2(p-value)**	*Yes*	*χ 2(p-value)**
	. % (95% CI)		**% (95% CI)**	
	18.2(17.1-19.3)		**2.4(2.1-2.8)**	
Age of the women		**18.64(<0.001)**		**14.15(<0.001)**
15-19	12.2(10.7-13.8)		0.3(0.2-0.7)	
20-24	21.2(19.2-23.4)		2.4(1.7-3.3)	
25-29	23.4(21.2-25.8)		4.2(3.3-5.3)	
30-34	20.9(18.6-23.4)		3.9(3.0-5.2)	
35-39	20.2(17.8-22.8)		3.4(2.4-4.8)	
40-44	14.5(12.4-17.1)		1.3(0.8-2.2)	
45-49	11.7(9.5-17.1)		0.9(0.4-1.8)	
Level of education		**327.76(<0.001)**		**393.42(<0.001)**
No formal education	6.4(5.2-7.7)		0.3(0.2-0.6)	
Primary	10.2(8.7-11.8)		0.3(0.2-0.7)	
Secondary	17.2(16.0-18.4)		1.0(0.7-1.3)	
Higher	53.5(50.0-57.0)		16.9(14.4-19.9)	
Marital status		**8.81(<0.001)**		**4.29(<0.001)**
Never in union	21.2(19.6-22.9)		2.8(2.2-3.5)	
Married	18.0(16.5-19.5)		2.9(2.3-3.5)	
Cohabiting	13.5(11.7-15.5)		1.0(0.6-1.7)	
Widowed	12.5(8.3-18.3)		0.9(0.2-4.2)	
Divorced	19.6(15.0-25.1)		1.4(0.4-4.3)	
Separated	14.8(11.9-18.4)		1.3(0.7-2.6)	
Religion		**10.62(<0.001)**		**3.55(0.029)**
Christians	19.5(18.3-20.7)		2.6(2.2-3.1)	
Muslims	14.7(12.7-16.8)		1.9(1.4-2.8)	
Traditionalist/none/other	10.2(6.5-15.7)			
Current working status		**6.15(0.013)**		**15.55(<0.001)**
Not working	16.4(14.8-18.1)		1.5(1.1-2.0)	
Working	18.8(17.6-20.1)		2.7(2.3-3.2)	
Reads a newspaper at least once a week		**50.75(<0.001)**		**42.32(<0.001)**
No	17.7(16.6-18.7)		2.2(1.9-2.6)	
Yes	32.2(27.6-37.2)		7.6(5.2-11.1)	
Watches television at least once a week		**94.09(<0.001)**		**19.49(<0.001)**
No	13.3(12.2-14.6)		1.5(1.2-2.0)	
Yes	21.2(19.9-22.6)		3.0(2.5-3.5)	
Listens to radio at least once a week		**39.12(<0.001)**		**18.79(<0.001)**
No	15.5(14.2-16.7)		1.9(1.5-2.3)	
Yes	21.9(20.2-23.7)		3.1(2.6-3.8)	
Use the internet at least once a week		**313.98(<0.001)**		**283.53(<0.001)**
No	11.3(10.3-12.4)		0.6(0.4-0.8)	
Yes	29.3(27.5-31.2)		5.4(4.6-6.3)	
Ever had sex		3.13(0.077)		2.87(0.091)
No	16.2(14.1-18.6)		1.7(1.1-2.7)	
Yes	18.5(17.4-19.7)		2.5(2.2-3.0)	
Ever tested for HIV		**128.12(<0.001)**		**122.31(<0.001)**
No	12.3(11.2-13.6)		0.4(0.3-0.7)	
Yes	22.5(21.1-24.1)		3.9(3.3-4.6)	

Table 2 (continued)

Variables	Know HIV Self-Test Kit		Ever Self-Tested for HIV	
	Yes	*χ 2(p-value)**	*Yes*	*χ 2(p-value)**
	. % (95% CI)		**% (95% CI)**	
	18.2(17.1-19.3)		**2.4(2.1-2.8)**	
Wealth index		**95.64(<0.001)**		**76.49(<0.001)**
Poorest	9.6(8.2-11.2)		0.4(0.2-0.8)	
Poorer	10.9(9.4-12.5)		0.5(0.3-0.8)	
Middle	13.8(12.1-15.7)		1.1(0.8-1.6)	
Richer	20.0(17.9-22.2)		2.4(1.8-3.2)	
Richest	32.7(30.2-35.2)		6.6(5.6-7.8)	
Place of residence		**85.69(<0.001)**		**32.04(<0.001)**
Urban	22.3(20.8-23.9)		3.3(2.7-3.9)	
Rural	12.7(11.5-14.0)		1.3(1.0-1.7)	
Region		**5.41(<0.001)**		**2.12(<0.001)**
Western	17.2(14.0-20.9)		1.4(0.7-2.5)	
Central	15.5(12.6-19.0)		1.2(0.7-2.3)	
Greater Accra	25.1(22.0-25.1)		2.4(1.6-3.7)	
Volta	23.3(19.1-28.0)		4.3(2.8-6.5)	
Eastern	19.1(16.6-22.0)		2.3(1.5-4.1)	
Ashanti	17.3(14.4-20.6)		2.8(1.8-4.3)	
Western North	17.9(14.4-21.6)		2.5(1.5-4.1)	
Ahafo	14.3(11.2-18.1)		2.0(0.9-4.4)	
Bono	19.9(15.9-24.6)		2.8(1.8-4.5)	
Bono East	15.9(12.8-19.7)		2.4(1.3-4.3)	
Oti	18.3(15.8-21.1)		2.4(1.4-4.2)	
Northern	13.5(9.9-18.3)		3.9(2.2-6.6)	
Savannah	6.3(4.0-9.7)		0.5(0.2-1.1)	
North East	11.3(7.9-16.1)		1.1(0.6-2.1)	
Upper East	20.4(15.7-26.1)		2.5(1.6-4.0)	
Upper West	15.2(11.8-19.3)		2.2(1.4-3.4)	

* *p*-values obtained from chi-square, *χ 2=designed based-chi square*

[aOR=4.31, 95% CI=1.31, 13.02]. Finally, women from regions (Northern [aOR=8.25, 95% CI=2.41, 28.17], Oti [aOR=7.25, 95% CI=2.19, 24.01], Volta [aOR=6.97, 95% CI=2.37, 20.55], Upper West [aOR=6.97, 95% CI=1.94, 25.03], Upper East [aOR=6.67, 95% CI=2.16, 20.64] Bono [4.0, 95% CI=1.31, 12.18] and Bono East [aOR=3.72, 95% CI=1.26, 11.02] have higher odds of self-testing for HIV compared to those in Greater Accra.

Random effects results of the factors influencing HIV Self-Testing

Random effect results revealed a variation in the factors influencing HIV Self-Testing among Ghanaian women among the clusters (σ2=9.90, 95% CI=7.91, 12.38). About 75% of HIV Self-Testing was attributed to the variations between the clusters (intra-cluster correlation coefficient (ICC)=0.75). This between-cluster difference reduced to 67% in Model II and a further declined to 63% in Model III. This difference was maintained at 63% in Model IV. These ICCs suggest that the likelihood of HIV Self-Testing variations can be attributed to the variances across the clusters.

Discussion

This study utilised a multi-level analysis to determine the prevalence of HIV Self-Testing Kits and HIV self-testing and its correlates among Ghanaian women using data from the 2022 Ghana Demographic and Health Survey. Our findings revealed that about eight in ten women do not have sufficient knowledge of Self-Test Kits. In recent years, Ghana has made strides in implementing and scaling up HIVST to introduce an HIV Testing Service (HTS) approach that will boost HTS coverage by improving case findings and reaching under-served populations who

Table 3 Fixed effects of the factors influencing Knowledge of HIV-Test Self Kit among Ghanaian women

Covariates	Model I	Model II aOR [CI]	Model III aOR [CI]	Model IV aOR [CI]
Fixed effects				
Age of the women				
15-19		1.00		1.00
20-24		1.30* [1.05, 1.60]		1.33**[1.07, 1.64]
25-29		1.21 [0.94, 1.56]		1.22 [0.94, 1.57]
30-34		1.07 [0.78, 1.46]		1.06 [0.78, 1.46]
35-39		1.26 [0.95, 1.67]		1.24 [0.94, 1.65]
40-44		0.98 [0.67, 1.41]		0.95 [0.65, 1.37]
45-49		0.93 [0.64, 1.35]		0.90 [0.62, 1.31]
Marital status				
Never in union		1.00		1.00
Married		0.69***[0.56,0.86]		0.67*** [0.54, 0.84]
Cohabiting		0.63***[0.49,0.81]		0.64*** [0.50, 0.82]
Widowed		0.56*[0.34,0.93]		0.58* [0.35, 0.97]
Divorced		0.94[0.60,1.47]		0.94 [0.61, 1.47]
Separated		0.69*[0.48,1.00]		0.71[0.49, 1.02]
Level of education				
No formal education		1.00		1.00
Primary		1.30 [0.97,1.75]		1.28 [0.95, 1.72]
Secondary		1.89*** [1.45,2.48]		1.78*** [1.35, 2.34]
Higher		7.20*** [5.21,9.94]		6.14*** [4.41, 8.55]
Current working status				
Not working		1.00		1.00
Working		1.13[0.95,1.33]		1.13 [0.95, 1.34]
Religion				
Christians		1.00		1.00
Muslims		1.07[0.85,1.35]		1.09 [0.86, 1.37]
Traditionalist/none/other		1.06[0.64,1.76]		1.10 [0.66, 1.84]
Reads a newspaper at least once a week				
No		1.00		1.00
Yes		0.95[0.72,1.26]		0.93 [0.70, 1.23]
Listens to radio at least once a week				
No		1.00		1.00
Yes		1.41***[1.20,1.65]		1.41*** [1.20, 1.65]
Watches television at least once a week				
No		1.00		1.00
Yes		1.16[0.99,1.35]		1.08 [0.92, 1.27]
Use the internet at least once a week				
No		1.00		1.00
Yes		1.59***[1.33,1.91]		1.49*** [1.24, 1.78]
Ever tested for HIV				
No		1.00		1.00
Yes		1.85***[1.57,2.19]		1.84*** [1.56, 2.18]
Wealth index				
Poorest			1.00	1.00
Poorer			1.25 [0.98,1.59]	1.06 [0.82, 1.37]
Middle			1.74*** [1.32,2.29]	1.20 [0.89, 1.62]
Richer			2.89*** [2.19,3.80]	1.52**[1.12, 2.06]

Table 3 (continued)

Covariates	Model I	Model II aOR [CI]	Model III aOR [CI]	Model IV aOR [CI]
Richest			5.37*** [3.98,7.25]	1.85*** [1.32, 2.58]
Place of residence				
Urban			1.00	1.00
Rural			0.77* [0.62,0.95]	0.84 [0.68, 1.05]
Region				
Western			0.80 [0.57,1.11]	0.81 [0.58, 1.14]
Central			0.80 [0.57,1.12]	0.78 [0.55, 1.11]
Greater Accra			1.00	1.00
Volta			1.35 [0.93,1.97]	1.28 [0.87, 1.89]
Eastern			1.17 [0.88,1.54]	1.08 [0.80, 1.45]
Ashanti			0.73 [0.52,1.01]	0.65* [0.47, 0.92]
Western North			1.41* [1.01,1.99]	1.32 [0.93, 1.86]
Ahafo			1.13 [0.74,1.74]	1.07 [0.69, 1.66]
Bono			1.27 [0.90,1.78]	1.22 [0.87, 1.72]
Bono East			1.01 [0.65,1.56]	1.02 [0.67, 1.56]
Oti			1.81***[1.32,2.47]	1.78*** [1.28, 2.46]
Northern			0.73 [0.48,1.12]	0.88 [0.57, 1.38]
Savannah			0.39** [0.21,0.71]	0.46* [0.25, 0.84]
North East			0.80 [0.48,1.34]	0.94 [0.56, 1.59]
Upper East			1.94** [1.27,2.96]	1.68* [1.11, 2.54]
Upper West			1.19 [0.76,1.87]	1.22 [0.78, 1.93]
Random effect model				
PSU variance (95% CI)	1.16 [0.95, 1.43]	0.78 [0.62, 0.98]	0.74 [0.60, 0.91]	0.70 [0.57, 0.86]
ICC	0.26 [0.22, 0.30]	0.19 [0.16, 0.23]	0.18 [0.15, 0.21]	0.18 [0.15, 0.21]
N	15,014	15,014	15,014	15,014
Number of clusters	618	618	618	618

aOR adjusted Odds ratio, 95% confidence intervals (CI) in brackets, Intra-Cluster Correlation coefficient (ICC), *PSU* Primary Sampling Unit, *N* Number of observations, 1.00=reference

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

may otherwise not be reached by traditional approaches to HTS [52]. However, not much has been done to educate or inform the public on the use of the test kits [52]. This could explain why about four-fifths of the women had inadequate knowledge of test kits used for HIV self-testing.

Not surprisingly, we discovered that the prevalence of HIV self-testing among Ghanaian women was 2.4%. Thus, more than nine in ten Ghanaian women in their reproductive ages had never self-tested for HIV or used the HIVSTK. The observed low HIVST may be attributed to the observed low knowledge in the study as knowledge could increase the potential for uptake of the HIVST. People must know about a product before they use it. Additionally, the low HIVST may be attributed to such reasons from a study by the National Aids Control Program [NACP] to determine the feasibility of HIVST [52]. The study by NACP discovered that while the piloting had success, concerns over lack of counseling, poor linkage to care, and obtaining the HIVST kits in ways that do not compromise privacy and anonymity were raised [52]. Further, challenges that have typically been associated with the success of self-testing, such as the expense of purchasing self-test kits, poverty, illiteracy, and fear of discovering one's HIV status, as well as potential psychological and social harms may also be linked to possible hurdles to HIVST among Ghanaian women [53, 54].

This low self-testing has significant implications for public health and may well forestall the objectives of the HIV Self-Testing policy in Ghana. The goal of the HIVST implementation in Ghana is to establish an approach to HIV Testing Services that will increase HTS coverage by enhancing case findings and reaching underserved communities that conventional HTS approaches might not

Table 4 Fixed effects of the factors influencing HIV-Self Testing among Ghanaian women

Covariates	Model I	Model II aOR (CI)	Model III aOR (CI)	Model IV aOR (CI)
Fixed effects				
Age of the women				
15-19		1.00		1.00
20-24		1.20[0.49, 2.92]		1.24 [0.50, 3.07]
25-29		1.12[0.45, 2.79]		1.13 [0.45, 2.86]
30-34		1.21[0.45, 3.28]		1.20 [0.44, 3.30]
35-39		1.30[0.49, 3.44]		1.24 [0.47, 3.29]
40-44		0.81[0.27, 2.42]		0.79 [0.26, 2.39]
45-49		0.67[0.21, 2.13]		0.63 [0.20, 2.02]
Marital status				
Never in union		1.00		1.00
Married		0.62 [0.37, 1.04]		0.60 [0.35, 1.01]
Cohabiting		0.49* [0.26, 0.94]		0.53 [0.28, 1.01]
Widowed		0.32 [0.04, 2.84]		0.32 [0.03, 3.07]
Divorced		0.65 [0.15, 2.87]		0.67 [0.15, 2.98]
Separated		0.67 [0.26, 1.68]		0.75 [0.29, 1.93]
Level of education				
No formal education		1.00		1.00
Primary		0.92 [0.33, 2.54]		0.91 [0.33, 2.52]
Secondary		1.96 [0.93, 4.13]		1.72 [0.82, 3.62]
Higher		27.49***[12.83, 58.90]		20.29*** [9.16, 44.97]
Current working status				
Not working		1.00		1.00
Working		1.47 [0.95, 2.29]		1.45 [0.93, 2.25]
Religion				
Christians		1.00		1.00
Muslims		0.78 [0.40, 1.51]		0.76 [0.39, 1.48]
Traditionalist/none/other		0.79 [0.15, 4.06]		0.86 [0.15, 4.88]
Reads a newspaper at least once a week				
No		1.00		1.00
Yes		0.97[0.53, 1.80]		0.95 [0.51, 1.77]
Listens to radio at least once a week				
No		1.00		1.00
Yes		1.49*[1.03, 2.15]		1.51*[1.05, 2.17]
Watches television at least once a week				
No		1.00		1.00
Yes		0.76 [0.49, 1.16]		0.67[0.43,1.06]
Use the internet at least once a week				
No		1.00		1.00
Yes		2.13*** [1.37, 3.31]		1.80*[1.15,2.83]
Ever tested for HIV				
No		1.00		1.00
Yes		6.77***[3.37,13.59]		6.73***[3.34,13.55]
Wealth index				
Poorest			1.00	1.00
Poorer			1.45 [0.55, 3.79]	1.02 [0.37,2.81]
Middle			4.33**[1.62, 11.58]	2.23 [0.78,6.35]
Richer			11.51***[4.39, 30.16]	2.56 [0.87,7.49]

Table 4 (continued)

Covariates	Model I	Model II aOR (CI)	Model III aOR (CI)	Model IV aOR (CI)
Richest			44.89*** [16.74, 120.38]	4.13* [1.31,13.02]
Place of residence				
Urban			1.00	1.00
Rural			0.63 [0.37, 1.06]	0.65 [0.37, 1.14]
Region				
Western			0.56 [0.17, 1.87]	0.59 [0.17, 2.10]
Central			0.79 [0.24, 2.62]	0.74 [0.21, 2.62]
Greater Accra			1.00	1.00
Volta			8.93*** [3.25, 24.58]	6.97*** [2.37, 20.55]
Eastern			3.01* [1.10, 8.24]	2.51 [0.85, 7.46]
Ashanti			2.37 [0.93, 6.04]	1.94 [0.73, 5.19]
Western North			4.89** [1.51, 15.83]	3.42 [0.97, 12.03]
Ahafo			2.65 [0.66, 10.60]	1.81 [0.44, 7.39]
Bono			4.57** [1.58, 13.23]	4.00* [1.31, 12.18]
Bono East			4.43** [1.56, 12.60]	3.72* [1.26,11.02]
Oti			8.99*** [2.88, 28.06]	7.25** [2.19,24.01]
Northern			7.15*** [2.58, 19.81]	8.25*** [2.41,28.17]
Savannah			1.00 [0.22, 4.45]	0.97 [0.22,4.39]
North East			7.18** [1.99, 25.95]	7.53** [1.83,31.06]
Upper East			13.72*** [4.78, 39.32]	6.67** [2.16,20.64]
Upper West			9.46*** [3.09, 28.96]	6.97** [1.94, 25.03]
Random effect model				
PSU variance (95% CI)	9.90 [7.91, 12.38]	6.63 [4.99, 8.81]	5.65 [4.32, 7.41]	5.59 [4.27, 7.33]
ICC	0.75 [0.71, 0.79]	0.67 [0.60, 0.73]	0.63 [0.57, 0.69]	0.63 [0.57, 0.69]
N	15,014	15,014	15,014	15,014
Number of clusters	618	618	618	618

aOR adjusted Odds ratio, 95% confidence intervals (CI) in brackets, Intra Cluster Correlation coefficient (ICC), *PSU* Primary Sampling Unit, *N* Number of observations, 1.00 reference

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

otherwise be able to get [50]. Its primary goals are to expand access to HIV testing services for people at high risk or who are not seeking standard care and to offer high-quality, reasonably priced HIVST services nationwide. However, based on the nationally representative data, the results obtained woefully defeat the purpose and objectives of the policy. Additionally, the results imply that Ghana may fall short of achieving Sustainable Development Goal 3.1 which seeks to end the epidemics of AIDS by 2030 United Nations [45] thus, having repercussions for public health.

The reported prevalence of HIVST in this study falls below the findings from a South African study that obtained a self-testing prevalence of less than 10% among men and women using the Demographic and Health Survey [49]. The discrepancy between the results could be associated with variations in awareness of HIVST as Awopegba and colleagues reported that the awareness level in South Africa remains very low. Also, the HIVST prevalence obtained is inconsistent with findings from a Malawian study that discovered 40.1% HIV self-testing among women [50]. This significant difference may be associated with the fact that the Malawian study was a community-based program and included both males and females while this study exclusively considered females using nationally representative data. The low HIVST rates and related issues raise concern for the need for enlightenment about HIVST among women of reproductive age in Ghana. Increasing the awareness of HIVST will prove beneficial as this method of HIV testing is adaptable, practical, and eliminates some of the confidentiality issues that afflict conventional testing. This will generally achieve the aim of HIVST which provides privacy as well as eliminates potential barriers to HIV testing.

Determinants of knowledge of HIV self-testing kits

Age education and exposure to media as predictors

Our findings revealed that women aged between 20–24 years had higher odds of knowing about the HIV self-test kit. This age group may typically have more opportunities to have access to health information about HIV as the years go by compared with those in their late adolescent stages. Compared with women without formal education, we discovered that women with higher levels of education were six times more likely to know about the self-testing kits. Women with higher education such as those who have gone through college or university have several opportunities to learn much about health issues through their curriculum, seminars, and workshops. Such exposures may put them in the position to learn and get acquainted with such health issues as HIV and its testing. This may explain the high odds of knowledge among the highly educated in this study. These observations indicate that health education including those that target HIVST should take into consideration for uneducated or those without any formal education. It is essential to highlight that women who listened to the radio or used the internet at least once a week had higher knowledge of HIV self-testing kits. This may be explained by the fact that radio programs and the internet serve as a conduit for the dissemination of health messages including HIV/AIDS. Exposure to such information, therefore, may equip potential listeners with adequate knowledge of HIV self-testing kits.

Predictors of HIVST

Education as a predictor of HIVST

We found the level of education to be an important predictor of HIVST. In both our bivariable and multivariable analyses, women with a higher level of education had higher odds of HIV self-testing compared to those without formal education. This result aligns with findings from Ethiopia [49]. Additionally, the result is consistent with discoveries from a South African and Malawian study where higher education was significantly linked to HIV self-testing [49, 50]. This builds upon prior studies by establishing the association of the correlation using the Demographic and Health Survey data. Based on available data, people with higher education levels tend to know more about HIV than people with only a secondary education or less [55]. A plausible reason for this result may stem from the fact that with increased knowledge of HIV among those who are highly educated, the perceived severity of HIV may be high leading to an increased willingness to test for HIV by oneself or others. This puts the highly educated at an advantage compared to the uneducated. These compared results thus support the evidence that attaining a higher level of education may prove helpful in gaining control over one's health compared with individuals without formal education. To achieve the objectives set forth for expanding HIV testing services to vulnerable populations and those who lack such services, it is essential to increase awareness and education services to those with low or no education. This will contribute to bridging the knowledge gap in HIV self-testing.

Exposure to radio and the internet as a predictor

Furthermore, it is worth considering that participants who listened to the radio or used the internet at least once a week had higher odds of testing for HIV by themselves. This closely aligns with results from research undertaken in Sub-Saharan Africa using evidence from 21 African countries where media exposure was significantly linked to HIVST [41]. This observation builds on existing evidence that media exposure has a role of media in health education. It is noticeable that having gained knowledge through these media, participants may have the confidence to self-test for HIV. Given this knowledge, stakeholders, the government as well as the Ghana Aids Commission can leverage various media channels including the radio, television as well as the internet to spread the message about HIVST.

Wealth index as a predictor

The wealth index was also identified as an essential predictor of HIVST. Our bivariable and multivariable analyses showed that those who belonged to the wealthiest category of the wealth index were more likely to have done HIV self-testing compared to those within the poorest wealth category. This observation supports evidence generated from a Kenyan study that found that women who were in the third, fourth, or fifth wealth quintiles had higher odds of HIV self-testing compared to the poorest quintiles [56]. The association in the compared study further extends the understanding of socio-economic status of individuals greatly influence people's access to and utilization of HIVST. A plausible reason underpinning this observed result could be due to the purchasing power of those from the wealthy class. Being that HIVST comes with a cost, those who are marginally poor may lack the necessary resources to access testing kits to undergo self-tests at their convenience. The finding underscores the need for all populations to be reached regardless of their socio-economic status. By way of ensuring that test kits for HIV are cost-effective, individuals with limited financial resources can have access and self-test themselves. This may involve providing test kits at affordable prices that those from the poor wealth quantile can also access. Generally, the odds of self-testing increased with

increasing wealth index and level of education among the population.

Past history of HIVST as a predictor

Apart from the level of education, wealth index and exposure to media, we found that ever being tested for HIV by a health worker significantly predicted the possibility of practicing HIVST. Specifically, our regression analyses revealed that those who had ever been tested for HIV by a health worker had higher odds of self-testing compared to those who had never had any past testing experience. This result corroborates findings from a Ugandan study that found that HIVST was significantly correlated with past history of being for HIV by a health worker [57]. Health workers may have provided education or information to clients on the need for regular HIV testing at the initial encounter which would have raised awareness for subsequent testing. Additionally, familiarity and the experience of comfort during the initial encounter may have encouraged women to undergo self-testing. This prior experience may be a force for good in empowering individuals to take control over their health.

Working status as a predictor

A notable observation from our study was also that women who were working were more likely to self-test for HIV compared to those with those who were not working. Participants who work may have several possibilities to self-test for HIV compared to non-workers. For instance, those who work may have a stable source of income which may increase their accessibility to health services compared to non-workers who may have unstable incomes. Those working may differ in such demographic factors including age and education which may increase their chances of getting tested themselves. The correlation between HIVST and working status emphasises the need for increased enlightenment even among non-working populations.

Conclusion

Our study revealed a very shallow knowledge of HIV Self-Testing Kit as well as a low prevalence of HIV self-testing among women in their reproductive age in Ghana. The evidence suggests that more than nine in ten women had never undertaken an HIV self-test. Our study unearthed that listening to the radio or using the internet at least once a week, attainment of higher education, and being aged 20–24 years amongst others influenced the knowledge of HIV self-test kit. We found that HIV self-testing was significantly higher among the highly educated, those from the highest wealth quantile and those who had ever been tested for HIV. The observed knowledge of HIV Self-Testing Kits and the prevalence of HIVST in this study may have implications for achieving the objectives of the HIVST policy which is geared at expanding access to vulnerable and at-risk populations as well as impede the achievement of SDG 3.3 which seeks to end the AIDS epidemic by 2030. To accelerate the testing rate, the Ghana Aids Commission may leverage the implementation policies outlined in the National Aids Control Program. Practical strategies including education and awareness creation of HIV Self-Testing Kits and resultant HIVST through electronic media such as the radio and television may be utilized primarily among those with little or no education. Also, health education programs through durbars and outreach efforts can be targeted at women who may have little to no information of HIVST. Additionally, the government can subsidize testing kits to create opportunities for those in the low-wealth quintiles to purchase and self-test themselves.

Weaknesses and contributions of the study

Data from the study was utilized from the 2022 Ghana Demographic and Health Survey. Being that the study design used for the survey was cross-sectional and offers a snapshot of the population, a potential weakness of this design is its inability to establish cause-and-effect relationships between prevalence or knowledge and the explanatory variables that were used. Additionally, there is the potential for social desirability with respect to HIV self-testing habits as is classical with self-reported data. Furthermore, the study relied solely on standardized questionnaires and this has the potential leave out aspects of cultural leanings and region-specific characteristics that may influence HIVST. Adding this would certainly have added to the richness of the study's results. The study, however, is significant in many regards. First, it is one of the few studies that have utilized DHS data to analyze the prevalence and correlations of HIVST among women and knowledge. Being a nationally representative data, it contributes significantly to the quality, representativeness, and robust sampling technique of the data. Additionally, the use of multi-level analysis provides a clear understanding of individual and context-specific predictors of HIVST that warrants appropriate interventions.

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Authors' contributions

TYA and HA conceptualized this study. TYA and RGA conducted the analysis. MF, EA and FT wrote the original manuscript. TYB, HA and BABJ provided valuable feedback, improving the manuscript's scientific merit. All authors participated in revising and editing the original manuscript draft, gave consent, read and approved the final manuscript for submission.

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Data availability
The data used for this study will be made available upon request. It is freely available for download at https://dhsprogram.com/data/available-datasets.cfm.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interest
The authors declare no competing interests.

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