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Research Article

Behavioral, Demographic and Clinical Determinants of HIV Status in Zambian Women

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ABSTRACT

The rate of Human Immunodeficiency virus (HIV) infection shows a diminishing trend globally while increasing in intensity of mortality, morbidity, and burden of HIV in Sub-Saharan Africa. The intertwined behavioral, demographic, and clinical determinants fueled the incidence of infections in Zambian women. This study aimed to determine the association between demographic, behavioral, and clinical determinants with HIV serostatus in Zambian women. With the conceptual framework of the World Health Organization's Commission for Social Determinants of Health (CSDH) and the quantitative method of MANOVA, this study examined Zambian Demographic Health Survey data for Zambian women of two ages groups (adolescent and adult). The findings showed statistically significant results in the association between HIV serostatus and self-perceived HIV risk for both groups and in the association between education and HIV serostatus among women in both groups. However, there was no statistically significant association between behavioral, demographic, and clinical determinants of HIV serostatus. These findings imply the need to conduct prospective studies on such determinants to curb HIV and improve women's community health in Africa.

Keywords: HIV serostatus; Determinants of HIV serostatus; Self-perceived HIV risk; Zambia

INTRODUCTION

Human Immunodeficiency Virus (HIV) is a virus that infects humans and leads to acquired Immune Deficiency Syndrome (AIDS), a lethal disease that weakens the immune system [1]. Approximately 37 million people live with the human immunodeficiency virus (HIV); about 2 million new infections and almost 1 million AIDS-related deaths occur each year [2].

Although infection rates of HIV/AIDS are decreasing globally, both infection rates and prevalence have increased in Zambia and other Sub-Saharan African countries [3,4]. Meager HIV prevention and insufficient access to clinical services are common issues in countries in this region. Ninety percent of HIV infections in this region is due to low condom use and multiple sexual partners [5]. In Zambia, about 14% of people aged 18-49 years have HIV [6].

The purpose of this study was to assess the associations between the behavioral, demographic, and clinical determinants of HIV serostatus in Zambian women. Findings from this study may inform methods to reduce new infections, deter mortality and morbidity associated with AIDS, and improve the quality of life for Zambian women living with HIV/AIDS.

Behavioral factors

Behavioral factors, such as multiple sexual partners, unprotected sex, nondisclosure of HIV positive serostatus, increased HIV new infections, and spread of HIV for adolescent and adult women contributes to the prevalence of HIV [7,8]. Mathur et al. found that, for heterosexual couples, having multiple sexual partners alone contributed to 15% of female HIV-positive cases and increased HIV prevalence by 4% for 15- to 19-year-old Zambian women [9]. Other researchers have found a positive correlation between the rate of HIV infection and sexual risk-taking in adolescent and adult women [10]. For 15- to 49-year-olds, risky sexual behaviors led to more significant increases in HIV prevalence for women than for men [11].

Demographic factors

HIV serostatus correlates with demographic variables such as age, sex, and location [12,13]. Found that women have higher HIV infection rates than men. Furthermore, Okawa et al. found

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that female adolescents did not understand HIV transmission methods, even though they were concerned about its effect in their future marriages. Kharsany and Karim found consistent increases in HIV infection and transmission rates in Zambian women aged 18–49 years; these rates are six times higher than those of similarly aged Zambian men. Both HIV/AIDS infection rates and HIV-associated deaths are higher among women [14,15]. Research also suggests that the risk level is higher in urban areas than in rural areas [12,13]. People who are unaware of their HIV status are at an elevated risk of spreading the virus. In Zambia, HIV affects 2.9% of the population, and an estimated 1.2 million women aged 15–49 years have HIV [16].

Clinical factors

Clinical factors include HIV diagnosis, individuals' relationships with their health care providers, and access to counseling. Some factors serve as barriers to HIV testing and treatment, whereas others (such as access to counseling) facilitate disease prevention.

MATERIALS AND METHODS

Ethical procedures

Ethical procedures were the formal requirements for conducting this study. I obtained a permission and an approval from Walden University Institutional Review Board before accessing and analyzing the the data for this study. The data description indicated the data were anonymous and personal information identifications were excluded to protect the anonymity of study participants.

Population

The study population included Zambian women 18 to 49 years old who were permanent residents in 8 provinces. The target population was from a demographic health survey conducted between 2009 and 2010. The demographic health survey contained 1,4441 responses from Zambian women aged 18 to 49 years old about fertility preferences, HIV status; fertility preferences; attitudes toward and knowledge about HIV, and attitudes toward and use of HIV services [17].

Sampling and sampling procedures

The sampling strategy divided each of the nine Zambian provinces Zambia into enumerative equal areas, based on the 2000 Zambian population and housing census. All households had the chance to be selected as part of the Zambian Demographic Health Survey (DHS) sample. The sampling procedure stratified the ZDHS sample into urban and rural areas. There were 18 sampling strata from the nine provinces. The samplers began with the Census Supervisory Area (CSA), then moved to the EA level, and finally independently selected enumeration areas for all stratifications. The sampling frame included Zambian women age 18 to 49 years old. The sampling frame excluded females younger than 18 years old, women older than 49 years old, and all males of any age. The research sample was sub-sampled from the 2007 Zambia Demographic and Health Survey (ZDHS). The sample was designed to provide specific indicators, including reproductive health indicators and HIV prevalence for each of the nine provinces in Zambia. Sorting the sample frame followed an implicit stratification and proportional allocation based on the geographical/administrative order and a probability proportional to size. Stratification sampling was completed before the selection of the sample [18]. Specific procedures guided the sample selection. Households were listed from 319 EAs. From each EA, an average of 25 households was selected through equal probability systematic sampling. Out of the average total of those EAs, the ones in Northern Province and Lusaka province were sub-sampled that shall be used for this study. I used a power analysis to determine the sample size. The power analysis to determine the sample size included the justification for the effect size, alpha level, the power level, and the citation source for calculating the sample size.

RESULTS

The purpose of the study was to investigate the association between dependent variables (HIV serostatus) and independent variables (behavioral determinants, demographic determinants, and clinical determinants) for Zambian women aged 18–49 years using secondary data collected in 2009–2010 from Zambia demographic health survey. In addition, I compared adolescents (aged 18–24 years) to adults (25–49 years) to determine whether there were differences in the associations between behavioral, demographic, and clinical determinants and that of the synergistic association of behavioral, demographic, and clinical determinants and HIV serostatus between these age groups.

A multiple analysis of variance (MANOVA) demonstrated a statistically significant ($p<0.01$) for the association between self-perceived HIV risk and HIV serostatus for Zambian women aged 18–24 (Table 1).

The multivariate tests for associations between the dependent variables: HIV test result, ever tested HIV, and ever tested AIDS) and behavioral determinants: sexual partners, condom use, and self-perceived risk for women aged 25–49. There was a statistically significant difference between self-perceived HIV risk and a linear combination of the three dependent variables. In this main effect, self-perceived HIV risk was statistically significant: Pillai's trace was 0.897, $F(2, 2410)=163.283$, $p<.001$; Wilks's lambda=0.121, partial $\eta^2=.448$ (Table 2).

The multivariate test demonstrated as follows: there was no statistically significant association between demographic determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24. Indicate the MANOVA results of hypothesis testing 3 by analyzing the associations between demographic determinants (location, education, and marital status) with the dependent variable HIV serostatus. It appeared a statistically significant association between education and a linear combination of the three dependent variables (Table 3).

Table 1: Multivariate tests on behavioral determinants of HIV serostatus for zambian women aged 18-24 years.

			df			
Effect and testa	**Value**	**F**	**Hypothesis**	**Error**	**p**	**Partial η²**
Intercept						
Pillai's trace	0.990	57,877.883b	2	1204	0.000	0.990
Wilks's lambda	0.010	57,877.883b	2	1204	0.000	0.990
Hoteling's trace	96.143	57,877.883b	2	1204	0.000	0.990
Roy's largest root	96.143	57,877.883b	2	1204	0.000	0.990
Sexual partners						
Pillai's trace	0.001	0.623b	2	1204	0.537	0.001
Wilks's lambda	0.999	0.623b	2	1204	0.537	0.001
Hotelling's trace	0.001	0.623b	2	1204	0.537	0.001
Roy's largest root	0.001	0.623b	2	1204	0.537	0.001
Condom use						
Pillai's trace	0.004	2.265b	2	1204	0.104	0.004
Wilks's lambda	0.996	2.265b	2	1204	0.104	0.004
Hotelling's trace	0.004	2.265b	2	1204	0.104	0.004
Roy's largest root	0.004	2.265b	2	1204	0.104	0.004
Self-perceived HIV risk						
Pillai's trace	0.897	163.283	12	2410	0.000	0.448
Wilks's lambda	0.121	375.987b	12	2408	0.000	0.652
Hotelling's trace	7.110	712.751	12	2406	0.000	0.780
Roy's largest root	7.089	1,423.669c	6	1205	0.000	0.876
Sexual partners × Condom use						
Pillai's trace	0.001	0.619b	2	1204	0.539	0.001
Wilks's lambda	0.999	0.619b	2	1204	0.539	0.001
Hotelling's trace	0.001	0.619b	2	1204	0.539	0.001
Roy's largest root	0.001	0.619b	2	1204	0.539	0.001
Sexual partners × Self-perceived HIV risk						
Pillai's trace	0.001	0.256	4	2410	0.906	0.000
Wilks's lambda	0.999	0.256b	4	2408	0.906	0.000
Hotelling's trace	0.001	0.256	4	2406	0.906	0.000
Roy's largest root	0.001	0.512c	2	1205	0.599	0.001
Condom use × Self-perceived HIV risk						
Pillai's trace	0.002	0.500	4	2410	0.736	0.001
Wilks's lambda	0.998	0.500b	4	2408	0.736	0.001
Hotelling's trace	0.002	0.500	4	2406	0.736	0.001
Roy's largest root	0.002	0.921c	2	1205	0.398	0.002
Sexual partners × Condom use × Self-perceived HIV risk						
Pillai's trace	0.000	0.175b	2	1204	0.840	0.000
Wilks's lambda	1.000	0.175b	2	1204	0.840	0.000
Hotelling's trace	0.000	0.175b	2	1204	0.840	0.000
Roy's largest root	0.000	0.175b	2	1204	0.840	0.000

NOTE: a) Design:
intercept+sexpartn+condouse+hivselfrisk+sexpartn*condouse+sexpartn*hivselfrisk+condouse*hivselfrisk+sexpartn*condouse*hivselfrisk.
b) Exact statistic.
c) The statistic is an upper bound on F that yields a lower bound on the significance level.

Table 2: Multivariate tests on behavioral determinants of HIV serostatus on Zambian women aged 25-49 years.

			df			
Effect and test	**Value**	**F**	**Hypothesis**	**Error**	**p**	**Partial η²**
Intercept						
Pillai's trace	0.99	57,877.883a	2	1204	0	0.99
Wilks's lambda	0.01	57,877.883a	2	1204	0	0.99
Hotelling's trace	96.143	57,877.883a	2	1204	0	0.99
Roy's largest root	96.143	57,877.883a	2	1204	0	0.99
Sexual partners						
Pillai's trace	0.001	0.623a	2	1204	0.537	0.001
Wilks's lambda	0.999	0.623a	2	1204	0.537	0.001
Hotelling's trace	0.001	0.623a	2	1204	0.537	0.001
Roy's largest root	0.001	0.623a	2	1204	0.537	0.001
Condom use						
Pillai's trace	0.004	2.265a	2	1204	0.104	0.004
Wilks's lambda	0.996	2.265a	2	1204	0.104	0.004
Hotelling's trace	0.004	2.265a	2	1204	0.104	0.004
Roy's largest root	0.004	2.265a	2	1204	0.104	0.004
Self-perceived HIV risk						
Pillai's trace	0.897	163.283	12	2410	0	0.448
Wilks's lambda	0.121	375.987a	12	2408	0	0.652
Hotelling's trace	7.11	712.751	12	2406	0	0.78
Roy's largest root	7.089	1,423.669b	6	1205	0	0.876
Sexual partners × Condom use						
Pillai's trace	0.001	0.619a	2	1204	0.539	0.001
Wilks's lambda	0.999	0.619a	2	1204	0.539	0.001
Hotelling's trace	0.001	0.619a	2	1204	0.539	0.001
Roy's largest root	0.001	0.619a	2	1204	0.539	0.001
Sexual partners × Self-perceived HIV risk						
Pillai's trace	0.001	0.256	4	2410	0.906	0
Wilks's lambda	0.999	0.256a	4	2408	0.906	0
Hotelling's trace	0.001	0.256	4	2406	0.906	0
Roy's largest root	0.001	0.512b	2	1205	0.599	0.001
Condom use × Self-perceived HIV risk						
Pillai's trace	0.002	0.5	4	2410	0.736	0.001
Wilks's lambda	0.998	0.500a	4	2408	0.736	0.001
Hotelling's trace	0.002	0.5	4	2406	0.736	0.001
Roy's largest root	0.002	0.921b	2	1205	0.398	0.002
Sexual partners × Condom use × Self-perceived HIV risk						
Pillai's trace	0	0.175a	2	1204	0.84	0
Wilks's lambda	1	0.175a	2	1204	0.84	0
Hotelling's trace	0	0.175a	2	1204	0.84	0
Roy's largest root	0	0.175a	2	1204	0.84	0

NOTE: a) Design:
intercept+sexpartn+condouse+hivselfrisk+sexpartn*condouse+sexpartn*hivselfrisk+condouse*hivselfrisk+sexpartn*condouse*hivselfrisk
b) Exact statistic
c) The statistic is an upper bound on F that yields a lower bound on the significance level.

Table 3: Multivariate tests on demographic determinants of HIV serostatus on Zambian women aged 18-24 years.

Effect and testa	Value	F	df Hypothesis	df Error	p	Partial η^2
Intercept						
Pillai's trace	0.927	5,109.357b	3	1215	0	0.927
Wilks's lambda	0.073	5,109.357b	3	1215	0	0.927
Hotelling's trace	12.616	5,109.357b	3	1215	0	0.927
Roy's largest root	12.616	5,109.357b	3	1215	0	0.927
Location						
Pillai's trace	0.002	0.914b	3	1215	0.433	0.002
Wilks's lambda	0.998	0.914b	3	1215	0.433	0.002
Hotelling's trace	0.002	0.914b	3	1215	0.433	0.002
Roy's largest root	0.002	0.914b	3	1215	0.433	0.002
Education						
Pillai's trace	0.015	2.099	9	3651	0.026	0.005
Wilks's lambda	0.985	2.106	9	2957.141	0.026	0.005
Hotelling's trace	0.016	2.111	9	3641	0.025	0.005
Roy's largest root	0.015	5.930c	3	1217	0.001	0.014
Marital status						
Pillai's trace	0.003	0.363	9	3651	0.953	0.001
Wilks's lambda	0.997	0.363	9	2957.141	0.953	0.001
Hotelling's trace	0.003	0.362	9	3641	0.953	0.001
Roy's largest root	0.002	0.964c	3	1217	0.409	0.002
Location × Education						
Pillai's trace	0.002	0.225	9	3651	0.991	0.001
Wilks's lambda	0.998	0.224	9	2957.141	0.991	0.001
Hotelling's trace	0.002	0.224	9	3641	0.991	0.001
Roy's largest root	0.001	0.496c	3	1217	0.685	0.001
Location × Marital status						
Pillai's trace	0.004	0.588	9	3651	0.808	0.001
Wilks's lambda	0.996	0.588	9	2957.141	0.808	0.001
Hotelling's trace	0.004	0.588	9	3641	0.808	0.001
Roy's largest root	0.004	1.576c	3	1217	0.193	0.004
Education × Marital status						
Pillai's trace	0.012	0.587	24	3651	0.944	0.004
Wilks's lambda	0.988	0.587	24	3524.471	0.944	0.004
Hotelling's trace	0.012	0.588	24	3641	0.944	0.004
Roy's largest root	0.01	1.449c	8	1217	0.172	0.009
Location × Education × Marital status						
Pillai's trace	0.007	0.506	18	3651	0.957	0.002
Wilks's lambda	0.993	0.506	18	3437.024	0.957	0.002
Hotelling's trace	0.007	0.505	18	3641	0.957	0.002
Roy's largest root	0.005	1.039c	6	1217	0.398	0.005

NOTE: a) Design: intercept+location+education+maritalst+location*education+location*maritalst+education*maritalst+location *education*maritalst.

b) Exact statistic

c) The statistic is an upper bound on F that yields a lower bound on the significance level.

Multivariate Tests on demographic determinants of HIV Serostatus on Zambian Women Aged 25–49 years indicated a statistically significant association between education and HIV serostatus for women aged 25–49 years. In this main effect education was statistically significant in its association with HIV serostatus: Pillai's trace was 0.015, F (9, 3651)=2.099, p=.026; Wilks's lambda was 0.985, partial η^2=.005 (Table 4).

The multivariate tests showed no statistically significant associations between clinical determinants (government services, clinic services, NGO services) with HIV serostatus for Zambian women of 25-49 years (Table 5).

As shown below, there were no statistically significant differences between clinical determinants and a linear combination of the three dependent variables (HIV serostatus, ever tested HIV, ever tested AIDS) for adult Zambian women of 25–49 years (Table 6).

Multivariate analysis of variance was also performed to test hypothesis 7 stated as follows: there is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adolescents from age 18 to 24. In addition, the synergistic associations between sexual partners, location, and government with HIV test results were not statistically significant (Table 7).

Multivariate analysis of variance (MANOVA) revealed no statistically significant synergistic association between behavioral, demographic, and clinical determinants and the HIV test result in Zambian female adults from age 25 to 49 (Table 8).

Table 4: Multivariate tests on demographic determinants of HIV serostatus on Zambian women aged 25-49 years.

			df			
Effect and testa	**Value**	**F**	**Hypothesis**	**Error**	**p**	**Partial η^2**
Intercept						
Pillai's trace	0.927	5,109.357b	3	1215	0	0.927
Wilks's lambda	0.073	5,109.357b	3	1215	0	0.927
Hotelling's trace	12.616	5,109.357b	3	1215	0	0.927
Roy's largest root	12.616	5,109.357b	3	1215	0	0.927
Location						
Pillai's trace	0.002	0.914b	3	1215	0.433	0.002
Wilks's lambda	0.998	0.914b	3	1215	0.433	0.002
Hotelling's trace	0.002	0.914b	3	1215	0.433	0.002
Roy's largest root	0.002	0.914b	3	1215	0.433	0.002
Education						
Pillai's trace	0.015	2.099	9	3651	0.026	0.005
Wilks's lambda	0.985	2.106	9	2957.141	0.026	0.005
Hotelling's trace	0.016	2.111	9	3641	0.025	0.005
Roy's largest root	0.015	5.930c	3	1217	0.001	0.014
Marital status						
Pillai's trace	0.003	0.363	9	3651	0.953	0.001
Wilks's lambda	0.997	0.363	9	2957.141	0.953	0.001
Hotelling's trace	0.003	0.362	9	3641	0.953	0.001
Roy's largest root	0.002	0.964c	3	1217	0.409	0.002
Location × Education						
Pillai's trace	0.002	0.225	9	3651	0.991	0.001
Wilks's lambda	0.998	0.224	9	2957.141	0.991	0.001
Hotelling's trace	0.002	0.224	9	3641	0.991	0.001
Roy's largest root	0.001	0.496c	3	1217	0.685	0.001
Location × Marital status						
Pillai's trace	0.004	0.588	9	3651	0.808	0.001
Wilks's lambda	0.996	0.588	9	2957.141	0.808	0.001
Hotelling's trace	0.004	0.588	9	3641	0.808	0.001
Roy's largest root	0.004	1.576c	3	1217	0.193	0.004
Education × Marital status						
Pillai's trace	0.012	0.587	24	3651	0.944	0.004
Wilks's lambda	0.988	0.587	24	3524.471	0.944	0.004
Hotelling's trace	0.012	0.588	24	3641	0.944	0.004
Roy's largest root	0.01	1.449c	8	1217	0.172	0.009
Location × Education × Marital status						
Pillai's trace	0.007	0.506	18	3651	0.957	0.002
Wilks's lambda	0.993	0.506	18	3437.024	0.957	0.002
Hotelling's trace	0.007	0.505	18	3641	0.957	0.002
Roy's largest root	0.005	1.039c	6	1217	0.398	0.005

NOTE: a) Design: intercept+location+education+maritalst+location*education+location*maritalst+education*maritalst+ location*education*maritalst

b) Exact statistic

c) The statistic is an upper bound on F that yields a lower bound on the significance level.

Table 5: Multivariate tests on clinical determinants of HIV serostatus for Zambian women aged 18-24 years.

Effect and testa	Value	Fb	p	Partial η^2
Intercept				
Pillai's trace	0.986	43,506.21	0	0.986
Wilks's lambda	0.014	43,506.21	0	0.986
Hotelling's trace	71.38	43,506.21	0	0.986
Roy's largest root	71.38	43,506.21	0	0.986
Clinic services				
Pillai's trace	0	0.17	0.844	0
Wilks's lambda	1	0.17	0.844	0
Hotelling's trace	0	0.17	0.844	0
Roy's largest root	0	0.17	0.844	0
NGO services				
Pillai's trace	0.003	1.658	0.191	0.003
Wilks's lambda	0.997	1.658	0.191	0.003
Hotelling's trace	0.003	1.658	0.191	0.003
Roy's largest root	0.003	1.658	0.191	0.003
Government services				
Pillai's trace	0	0.287	0.751	0
Wilks's lambda	1	0.287	0.751	0
Hotelling's trace	0	0.287	0.751	0
Roy's largest root	0	0.287	0.751	0
Clinic services × NGO services				
Pillai's trace	0	0.002	0.998	0
Wilks's lambda	1	0.002	0.998	0
Hotelling's trace	0	0.002	0.998	0
Roy's largest root	0	0.002	0.998	0
Clinic services × Government services				
Pillai's trace	0	0.006	0.994	0
Wilks's lambda	1	0.006	0.994	0
Hotelling's trace	0	0.006	0.994	0
Roy's largest root	0	0.006	0.994	0
NGO services × Government services				
Pillai's trace	0.001	0.597	0.551	0.001
Wilks's lambda	0.999	0.597	0.551	0.001
Hotelling's trace	0.001	0.597	0.551	0.001
Roy's largest root	0.001	0.597	0.551	0.001
Clinic services × NGO services × Government services				
Pillai's trace	0	0.089	0.915	0
Wilks's lambda	1	0.089	0.915	0
Hotelling's trace	0	0.089	0.915	0
Roy's largest root	0	0.089	0.915	0

Note: Hypothesis df=2, Error df=1219, NGO: Non-Governmental Organization.
a)Design:intercept+govtest+clinictest+ngotest+govtest*clinictest+govtest*ngotest+clinictest*ngotest+govtest*clinictest*ngotest
b) Exact statistic.

Table 6: Multivariate tests on clinical determinants of HIV serostatus for Zambian women aged 25-49 years.

Effect and testa	Value	Fb	p	Partial η^2
Intercept				
Pillai's trace	0.986	43,506.21	0	0.986
Wilks's lambda	0.014	43,506.21	0	0.986
Hotelling's trace	71.38	43,506.21	0	0.986
Roy's largest root	71.38	43,506.21	0	0.986
Clinic services				
Pillai's trace	0	0.17	0.844	0
Wilks's lambda	1	0.17	0.844	0
Hotelling's trace	0	0.17	0.844	0
Roy's largest root	0	0.17	0.844	0

NGO Services				
Pillai's trace	0.003	1.658	0.191	0.003
Wilks's lambda	0.997	1.658	0.191	0.003
Hotelling's trace	0.003	1.658	0.191	0.003
Roy's largest root	0.003	1.658	0.191	0.003
Government services				
Pillai's trace	0	0.287	0.751	0
Wilks's lambda	1	0.287	0.751	0
Hotelling's trace	0	0.287	0.751	0
Roy's largest root	0	0.287	0.751	0
Clinic services × NGO services				
Pillai's trace	0	0.002	0.998	0
Wilks's lambda	1	0.002	0.998	0
Hotelling's trace	0	0.002	0.998	0
Roy's largest root	0	0.002	0.998	0
Clinic services × Government services				
Pillai's trace	0	0.006	0.994	0
Wilks's lambda	1	0.006	0.994	0
Hotelling's trace	0	0.006	0.994	0
Roy's largest root	0	0.006	0.994	0
NGO services × Government services				
Pillai's trace	0.001	0.597	0.551	0.001
Wilks's lambda	0.999	0.597	0.551	0.001
Hotelling's trace	0.001	0.597	0.551	0.001
Roy's largest root	0.001	0.597	0.551	0.001
Clinic services × NGO services × Government services				
Pillai's trace	0	0.089	0.915	0
Wilks's lambda	1	0.089	0.915	0
Hotelling's trace	0	0.089	0.915	0
Roy's largest root	0	0.089	0.915	0

Note: Hypothesis df=2, Error df=1219, NGO: Non-Governmental Organization.
a)Design: intercept+govtest+clinictest+ngotest+govtest*clinictest+govtest*ngotest+clinictest*ngotest+govtest*clinictest*ngotest
b) Exact statistic.

Table 7: Multivariate tests on synergistic analysis of behavioral, demographic, and clinical determinants of HIV serostatus for Zambian women aged 18-24 years.

Effect and testa	Value	F	df Hypothesis	Error	p	Partial η^2
Intercept						
Pillai's trace	0.991	63,188.837b	2	1195	0	0.991
Wilks's lambda	0.009	63,188.837b	2	1195	0	0.991
Hotelling's trace	105.755	63,188.837b	2	1195	0	0.991
Roy's largest root	105.755	63,188.837b	2	1195	0	0.991
Sexual partners						
Pillai's trace	0.001	0.257	4	2392	0.905	0
Wilks's lambda	0.999	0.257b	4	2390	0.905	0
Hotelling's trace	0.001	0.257	4	2388	0.905	0
Roy's largest root	0.001	0.508c	2	1196	0.602	0.001
Location						
Pillai's trace	0.001	0.438b	2	1195	0.645	0.001
Wilks's lambda	0.999	0.438b	2	1195	0.645	0.001
Hotelling's trace	0.001	0.438b	2	1195	0.645	0.001
Roy's largest root	0.001	0.438b	2	1195	0.645	0.001
Government services						
Pillai's trace	0.87	460.457	4	2392	0	0.435
Wilks's lambda	0.13	1,058.488b	4	2390	0	0.639
Hotelling's trace	6.68	1,993.84	4	2388	0	0.77
Roy's largest root	6.679	3,994.196c	2	1196	0	0.87

Sexual partners × Location						
Pillai's trace	0.004	1.285	4	2392	0.273	0.002
Wilks's lambda	0.996	1.285b	4	2390	0.273	0.002
Hotelling's trace	0.004	1.285	4	2388	0.273	0.002
Roy's largest root	0.004	2.471c	2	1196	0.085	0.004
Sexual partners × Government services						
Pillai's trace	0.001	0.416b	2	1195	0.66	0.001
Wilks's lambda	0.999	0.416b	2	1195	0.66	0.001
Hotelling's trace	0.001	0.416b	2	1195	0.66	0.001
Roy's largest root	0.001	0.416b	2	1195	0.66	0.001
Location × Government services						
Pillai's trace	0	0.039	4	2392	0.997	0
Wilks's lambda	1	0.038b	4	2390	0.997	0
Hotelling's trace	0	0.038	4	2388	0.997	0
Roy's largest root	0	0.077c	2	1196	0.926	0
Sexual partners × Location × Government services						
Pillai's trace	0	–b	0	0	-	-
Wilks's lambda	1	–b	0	1195.5	-	-
Hotelling's trace	0	–b	0	2	-	-
Roy's largest root	0	0.000b	2	1194	1	0

NOTE: a)Design: intercept+sexpartn+location+govtest+sexpartn*location+sexpartn*govtest+location*govtest+sexpartn*location*govtes.
b) Exact statistic.
c) The statistic is an upper bound on F that yields a lower bound on the significance level.

Table 8: Multivariate tests on synergistic association of behavioral, demographic, and clinical determinants of HIV serostatus for zambian women aged 25-49 years.

			df			
Effect and testa	**Value**	**F**	**Hypothesis**	**Error**	**p**	**Partial η^2**
Intercept						
Pillai's trace	0.987	43575.177b	2	1183	0	0.987
Wilks's lambda	0.013	43575.177b	2	1183	0	0.987
Hotelling's trace	73.669	43575.177b	2	1183	0	0.987
Roy's largest root	73.669	43575.177b	2	1183	0	0.987
Self-perceived HIV risk						
Pillai's trace	0.011	1.292	10	2368	0.229	0.005
Wilks's lambda	0.989	1.294b	10	2366	0.228	0.005
Hotelling's trace	0.011	1.297	10	2364	0.226	0.005
Roy's largest root	0.011	2.597c	5	1184	0.024	0.011
Marital status						
Pillai's trace	0	0.051	6	2368	0.999	0
Wilks's lambda	1	0.051b	6	2366	0.999	0
Hotelling's trace	0	0.051	6	2364	0.999	0
Roy's largest root	0	0.102c	3	1184	0.959	0
NGO services						
Pillai's trace	0.001	0.552b	2	1183	0.576	0.001
Wilks's lambda	0.999	0.552b	2	1183	0.576	0.001
Hotelling's trace	0.001	0.552b	2	1183	0.576	0.001
Roy's largest root	0.001	0.552b	2	1183	0.576	0.001
Self-perceived HIV risk × NGO services						
Pillai's trace	0.008	0.329	28	2368	1	0.004
Wilks's lambda	0.992	0.329b	28	2366	1	0.004
Hotelling's trace	0.008	0.329	28	2364	1	0.004
Roy's largest root	0.008	0.657c	14	1184	0.817	0.008
Self-perceived HIV risk × NGO services						
Pillai's trace	0.002	0.186	10	2368	0.997	0.001
Wilks's lambda	0.998	0.186b	10	2366	0.997	0.001
Hotelling's trace	0.002	0.186	10	2364	0.997	0.001
Roy's largest root	0.002	0.370c	5	1184	0.869	0.002

Marital status × NGO services						
Pillai's trace	0.002	0.333	6	2368	0.92	0.001
Wilks's lambda	0.998	0.333b	6	2366	0.92	0.001
Hotelling's trace	0.002	0.333	6	2364	0.92	0.001
Roy's largest root	0.002	0.665c	3	1184	0.574	0.002
Self-perceived HIV risk × Marital status × NGO services						
Pillai's trace	0.002	0.264	10	2368	0.989	0.001
Wilks's lambda	0.998	0.264b	10	2366	0.989	0.001
Hotelling's trace	0.002	0.264	10	2364	0.989	0.001
Roy's largest root	0.002	0.527c	5	1184	0.756	0.002

Note: NGO: Non-Governmental Organization

a) Design: intercept+condouse+education+clinictest+condouse*education+condouse*clinictest+education*clinictest+condouse*education*clinictest

b) Exact statistic.

c) The statistic is an upper bound on F that yields a lower bound on the significance level.

DISCUSSION

Behavioral determinants of HIV serostatus

For both women aged 18–24 years and women aged 25–49 years, there was a significant association between HIV serostatus and self-perceived HIV risk but not sexual partners or condom use. This finding is partly consistent with Adeniyi et al, who also examined behavioral, demographic, and clinical determinants and HIV serostatus. However, Adeniyi et al. studied only one HIV serostatus variable compared to this study's three serostatus variables [19].

The findings indicated a link between the HIV test result variable and self-perceived HIV risk for women of 18–24 years. There was a strong association between the perception of no risk or small risk and HIV serostatus. Toska et al.[10] reported the presence of a direct association between HIV acquisition of adolescent women (aged 18–24 years) and having multiple sexual partners, although the finding was inconclusive. That finding was in harmony with a secondary analysis of a cross-sectional study conducted in Uganda, which indicated an association between self-perceived HIV risk and incidence of HIV infection among women of all ages. This study elucidates the impact of self-perceived HIV risk. It suggests a prevention strategy for Zambian women and also probably women in similar settings and socioeconomic statuses in other parts of sub-Saharan Africa [20]. reporting on a population-based study, said that the spread of HIV had accelerated in older adults in South Africa and recommended the commencement of prevention activities for analogous communities in sub-Saharan African countries.

Demographic determinants of HIV serostatus

The findings indicated a statistically significant association between education and HIV serostatus among women in both age groups. However, unlike previous studies, there were no statistically significant differences for the demographic variables of location and marital status and pairwise interactions of location and marital status, location and education, and marital status and education [7,21,22]. Reported that age and education were critical to determining HIV serostatus for adolescent and adult women at individual and societal levels. Lack of associations between HIV serostatus and age (adolescent versus adult) and location (urban versus rural) also contrasted with the findings of authors who stated strong and significant associations between HIV serostatus and age, gender, and location [12,13,23]. Found that being in school increased students' awareness of HIV and the practice of preventive measures and eventually contributed to diminishing the spread of HIV infection.

Other researchers failed to find an association between education and the use of HIV services [24]. Bunyasi and Coetzee suggested a direct association between accomplishment in education and the reduction of HIV prevalence [25]. The main reason for the association between a lower incidence of HIV and higher educational achievement may be the ability of educated people to implement safer sexual practices and abstain from sexual activity. Increased health literacy and academic progress could empower educated people to make informed decisions and take responsibility for themselves and their communities.

Clinical determinants of HIV serostatus

The findings indicated a significant association between aggregate use of HIV services and HIV serostatus for women in both age groups. This result neither confirmed nor refuted the conclusions reported by authors of systematic reviews, who implied that it was essential to conduct further studies to maximize prevention through the use of HIV medications [26,27]. However, there were no significant associations between HIV serostatus and the use of government services, clinic services, and NGO services considered individually. This finding agreed with the results of Mustapha, Musiime, Bakeera-Kitaka, Rujumba, and Nabukeera-Barungi regarding the use of HIV services by women in Uganda. Those authors stated that HIV services for women were substandard in one sub-Saharan country, Uganda [28]. Reported that women received motivation to use services from knowing HIV status and demotivation to use services from not knowing HIV serostatus, discrimination, and economic constraints.

Authors of systematic studies described the benefits of team-based HIV service access to improve HIV prevention in sub-Saharan African countries. Reviewers of quantitative and qualitative studies explicitly described associations between HIV serostatus and the use of team-based services versus institutionalized HIV services—government, clinic, and NGO [29]. The availability of HIV services in HIV-prone sub-Saharan African countries could be positive indicators of the containment of HIV spread and the deterrence of new infection. The use of HIV services in communities has the same level of importance. Along with HIV services, the implementation of precise HIV diagnostic tests to minimize false test outcomes is critical in sub-Saharan African countries [30].

Demographic, behavioral, and clinical determinants of HIV serostatus

Multivariate tests indicated no significant association between the synergistic association of Demographic, Behavioral, and Clinical Determinants with HIV Serostatus for Zambian women aged 18–24. Likewise, there was no significant association between sub-Saharan Africa [31]. The finding regarding the synergistic association between behavioral, demographic, and clinical determinants with HIV serostatus could not address the recommendation by Kharsany and Karim for a study of behavioral determinants and the HIV literacy (education) gap concerning HIV serostatus cognizance at the community level [14]. Synergistic association of Demographic, Behavioral, and Clinical Determinants with HIV Serostatus for Zambian women aged 25 to 49. The community strategy outlined by health professionals, policymakers, and other entities involved in HIV prevention should be a collective drive to manage HIV epidemics.

LIMITATIONS OF THE STUDY

This study had certain limitations. The exclusion of those aged younger than 18 years and older than 49 years, prisoners, and military personnel was one of the limitations. Because resource constraints dictated that the ZDHS surveyed only two provinces, the other eight provinces were excluded from data collection. The complete absence of men could be a significant limitation. Another limitation was that the study was cross-sectional rather than longitudinal. Thus, it lacked the benefits of conducting longitudinal research, including identifying temporal effects and associated changes in the dynamics of sexual behaviors, demographic shifts, and capacity and acceptability of HIV prevention services. The last limitation was the age of the data from the ZDHS. The laps of 10 years since the data were collected means that the data may not reflect the current situation. However, I could overcome this to some extent by extrapolating the findings through the lens of other consistent HIV research findings in sub-Saharan Africa. Thus, generalization of the results beyond the specific setting to other similar settings appears reasonable.

RECOMMENDATIONS

The recommendations in this section apply to Zambian women and women living in similar settings throughout sub-Saharan Africa. The consequences and risks of HIV prevail in older women. Future researchers can improve the robustness of their findings by including older women. Including this age group in HIV prevention efforts and will assist in significantly diminishing HIV in sub-Saharan Africa. According to Maughan-Brown and Venkataramani, the high prevalence of HIV in South Africa was because of risky sexual behaviors among older women [32]. National and international collaboration are pivotal to lessen the spread of HIV throughout the world because HIV is a public health threat in every country. A unified approach to HIV prevention and control would have collateral health benefits when supported with measurable goals and comprehensive strategies [33,34].

IMPLICATIONS

The dynamics of sexual behaviors and their associations with HIV serostatus indicate their impact on HIV prevalence, incidence, and epidemics in sub-Saharan Africa. One of the focuses was the paramount importance of the consolidation of leadership to mobilize communities for harmonized HIV response [35]. In conjunction with the findings on the associations of behavioral, demographic, and clinical determinants with HIV serostatus for Zambian women aged 18–49, the inclusion of female participants younger than 18 years and older than 49 years would yield more holistic findings that could be applied to fighting HIV [20].

CONCLUSION

The findings regarding the associations of behavioral, demographic, and clinical determinants with HIV serostatus can be used to project risk, inform prevention efforts, and initiate longitudinal research. These findings suggest that self-perceived HIV risk, education, and type of HIV services are reliable indicators of HIV serostatus. Effective HIV prevention and control in sub-Saharan countries should focus on developing Awareness using educational advancement as a tool, recognizing HIV risks through health literacy, and addressing social determinants of HIV health. These findings complement growing evidence indicating the benefits of collaborative HIV prevention efforts that involve HIV researchers and health professionals at both the local and international levels. Limitations of study: The small number of time points for initial phases of lockdown, that is, LD1, LD2, LD3 and LD4 contains 21,19,14,14 days respectively.

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CONFLICT OF INTEREST

The authors declare no conflict of interests

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