



# First Community - Based HIV Prevalence Estimate in Zambezi, Namibia: A Pathfinder Study

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## Abstract

**Background:** While great strides have been made in combating HIV, the epidemic remains a formidable challenge in populations that are difficult to reach. As a rural area that has seen improvements in HIV prevention and treatment over the past decade, the Zambezi region of Namibia may serve as a helpful model for other remote regions around the world. Quantitative studies from the region are still scarce, however, and data is needed to characterize the epidemiology and track trends in this highly impacted area.

**Objectives:** In 2012, we performed the first ever community-based HIV prevalence estimate in the Zambezi region.

**Method:** We examined correlates of HIV infection and barriers to care among 203 adults from villages near and distant from the Trans-Zambezi highway. Participants underwent testing for HIV and interviewer-administered surveys eliciting information on demographics, HIV knowledge and attitudes, HIV risk behaviors, medical history, mobility, and health care access. Correlates of HIV infection were determined using univariate and multivariate logistic regression.

**Results:** HIV prevalence was significantly higher in females (23% vs. 10%) and varied by age but not by village. Most participants (81%) reported difficulty obtaining condoms and 57% had never been tested for HIV previously - citing transportation and cost barriers. While a preponderance of participants (90%) understood main transmission routes of HIV, misconceptions and stigma were common. Among females, univariate associations with HIV infection included: Spouse/partner mobility, substance use by friends, and concerns about Sexually Transmitted Infections (STIs) in their community. Among males, correlates included: Having symptoms of an STI, higher socioeconomic status, and concern about community substance use.

**Conclusion:** While further research is warranted, our results suggest the potential for mobile healthcare strategies and preventive interventions targeting younger women. This study offers critical baseline data and a historical perspective of social correlates of HIV that may inform future intervention efforts in this region and similar remote settings.

**Keywords:** Barriers to care; Epidemiology; HIV prevalence

## Introduction

There remains a great need for evidence-based interventions and new approaches for curbing the HIV epidemic in Africa and elsewhere, especially in marginalized and isolated populations. As in other southern African countries, Namibia continues to be highly impacted by HIV. Adult HIV prevalence is 11.6% nationally, [1] but there are large geographical variations in prevalence and incidence and recent decreases in external funding which present ongoing challenges to maintaining control efforts [2].

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Within Namibia, the northeastern region of Zambezi has the highest HIV prevalence, with an estimated 24% of adults infected [3]. The region is largely rural, having an economy based mostly on small-scale farming and exploitation of wildlife resources organized within a conservancy system, yet it shares well-trafficked border crossings with Botswana, Zambia, Zimbabwe, and Angola. A major paved road bisects Zambezi and extends from Namibia across the continent. Over the past two decades, this Trans-Zambezi highway has resulted in increased commercial and international traffic, a rising number of traders and immigrants from economically depressed neighboring countries, and an increasing stream of long-haul truckers throughout southern Africa [4-6].

While several important ethnographic studies have documented the context of HIV transmission, and recent work has examined caregiver issues and correlates of depression among PLWH in Zambezi [7-13], quantitative studies regarding correlates of HIV status in this area are extremely limited. One such large prospective study suggests that rural areas tend to have higher HIV incidence relative to more populated, urban areas [14]. In light of these recent findings, our study of HIV prevalence correlates, using the first community-based testing strategy in two rural conservancies in Zambezi, provides an important baseline data of HIV prevalence and correlates in the region.

Following the release of mobile HIV testing guidelines in Namibia, which enabled "door-to-door" HIV testing for the first time, we conducted a pathfinder study to: (1) Estimate the prevalence of HIV in communities at different distances from the Trans-Zambezi highway and evaluate the role of individual mobility in HIV dynamics; and (2) determine correlates of HIV infection in this rural area. These results are from the first community-based HIV screening in the Zambezi region, and they represent an important historical case study as we continue to characterize this highly impacted region at the crossroads of multiple southern African nations. While global HIV prevalence has decreased substantially since this assessment was conducted, the correlates of infection and timely testing, as well as the challenges faced by rural communities, remain. Our study lends important insights into the progress of the epidemic in this area and may have wider applicability to rural settings globally.

## Methods

### Study population

In August 2012, a cross-sectional, interviewer-administered survey was conducted among 203 adults in the Zambezi (formerly Caprivi) Region of Namibia. This Eastern-most province is bordered on three sides by the countries of Angola, Zambia, Zimbabwe, and Botswana and transected by the Trans-Zambezi highway. Participants were recruited from villages within the conservancies of Sobbe and Dzoti; each having approximately 2000 residents. Sobbe is approximately 5 km east and Dzoti approximately 45 km south of the Trans-Zambezi highway.

Recruitment in villages was based on probability proportional to size methods [15], in an endeavor to better represent the population of the area. Local outreach workers introduced communities to the study through encounters on the street, traveling door-to-door, and through community gathering places (e.g., bars, community meetings). All individuals aged 18 or older within study communities were eligible and efforts were made to get representation from both sexes and to ensure that those working outside of the area were

included (e.g., by recruiting in various settings and at various times and days). A 10-item screener was used to assess eligibility - with 89% of those screened eligible and willing to participate in the full survey. We offered minimal reimbursement for participants' time, comprised of refreshments and in-kind goods worth no more than 3 USD. The ethics board of the Ministry of Health and Social Services of Namibia and the human research protections program of the University of California, San Diego approved study methods, and written informed consent was received from all participants.

### Data collection

After enrollment, trained interviewers administered a questionnaire eliciting information on demographics, HIV knowledge and attitudes, risk behaviors (e.g., sexual and alcohol/drug using behaviors), medical history, mobility (e.g., interactions with non-residents, recent travel history), and health care access and utilization (including barriers to accessing services). Questionnaires were administered in English or a local language, depending on participant preference. Pre- and post-test HIV counseling were provided by certified service providers [16]. Testing comprised initial parallel testing using the Determine HIV1/2 test (Abbott Laboratories) and the Unigold Rapid HIV Test (Trinity Bio-Tech). All tests were done on blood from a finger prick and reactive specimens were identified within 15 min to 20 min. If needed, the Hema Strip HIV test (Chembio) served as a tie breaker. Those positive were actively connected to available HIV care.

### Data analysis

Descriptive statistics were calculated to characterize participants by HIV status. Associations between participant characteristics and HIV status were evaluated first by univariate analyses (i.e., Chi-square, Fisher's exact or Mann-Whitney U-tests), and then by bivariate and multivariable logistic regression. All variables significant at the  $p \leq 0.20$  level in bivariate models were considered for inclusion in the multivariable model. We used a manual backward-stepwise approach where, at each step, the variable with the largest p-value was removed until all variables in the model had  $p \leq 0.10$ . Sample size precluded stratifying models by gender. Introducing study site within the multivariable model did not influence effect sizes; therefore we excluded it from the final model. Data analyses were performed using STATA version 12.0 (College Station, TX USA).

## Results

### Population characteristics

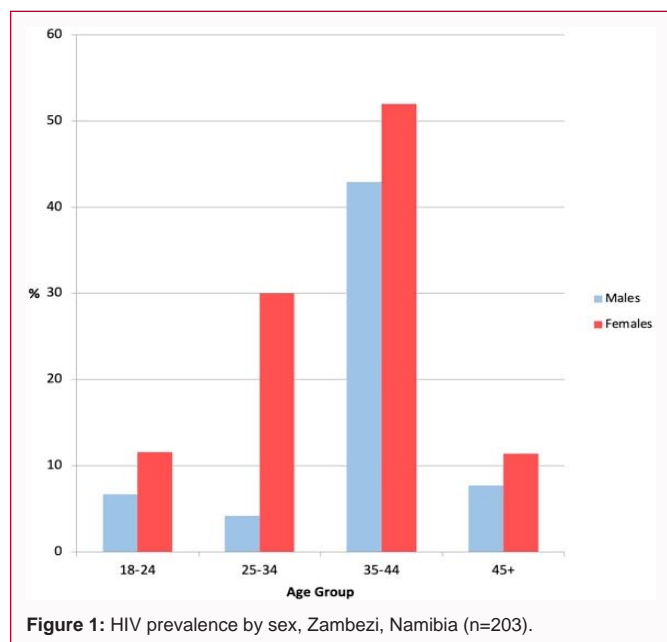
Median age of participants was 30 years (Inter-Quartile Range [IQR]: 23-44), with 70% female. A third reported earning money in the past year, most commonly through "piece work" (36.4%). However, women had half the odds of regularly earning money compared to men (28.9% vs. 42.9%). For those sexually active, mean number of sex partners in the past 6 months was 2.3 (range 1-20); 3.4% reported ever exchanging sex for money or goods; and 6.7% of males reported being circumcised. HIV prevalence overall was 19.6% but varied greatly by age and sex, reaching nearly 50% in 35 to 45-year-old women (Figure 1). Within the two conservancies, participants recruited in Sobbe were from 7 villages and participants in Dzoti were from >10 villages - reflecting it being less densely populated, further from the main road network. Despite this, HIV seroprevalence did not statistically significantly differ by conservancy.

### Univariate associations with HIV infection

HIV-positive men tended to live in households with more

**Table 1:** Univariate associations with HIV status in rural Zambezi, Namibia, 2012 (n=203).

Measure	Overall (n=203)		Female (n=14)		p-value	Male (n=60)		p-value
	%	n	HIV+	HIV-		HIV+	HIV-	
<b>Demographic Characteristics</b>								
Median age (IQR)	30 (23-44)	203	34.5 (31-41)	28 (23-45)	0.001	40 (33-44)	29 (24-43)	0.03
<b>Language of interview</b>								
Silozi	59.4	192	57.6	54.5	0.95	66.7	69.2	0.58
English	4.2	192	3	3		16.7	5.8	
Other	36.5	192	39.4	42.6		16.7	25	
<b>Education level</b>								
≤ Primary education	55.8	197	67.6	55.7	0.21	66.7	47.1	0.36
<b>Study site</b>								
Sobbe	52	203	55.9	52.8	0.75	50	48.1	0.93
Dzote	48	203	44.1	47.2		50	51.9	
<b>Economics and Household Characteristics</b>								
Earned money in past year	34	194	38.2	25.7	0.16	66.7	43.4	0.28
<b>Of those who earned money, survived on piece work</b>								
Visited cuca shopa (past year)	50.8	187	31.3	55.4	0.01	66.7	52.1	0.49
Household owns no livestock	31	203	47.1	31.2	0.09	16.7	22.2	0.75
Household members ever went hungry in past year	85.7	203	97.1	82.6	0.03	83.3	85.2	0.904
Household has access to pit latrine	92.1	203	94.1	93.6	0.91	33.3	86.3	0.01
Water tap in house	13	192	6.3	11.7	0.38	66.7	13.7	0.002
Electricity in house	1.6	183	0	1	1	40	0	0.006
Participant owns a car, bike, horse, other form of transportation	75.7	202	81.8	77.1	0.56	66.7	70.4	0.85
<b>Mobility</b>								
Visited Katima Mulilo (past year)	93.4	197	93.8	92.5	0.8	100	94.3	1
Visited Windhoek (past year)	14.8	189	21.9	13.1	0.23	0	15.1	1
Spouse/regular sex partner in conservancy on the day of survey	48.8	177	30	59.3	0.005	83.3	68.1	0.655
Sexual partner worked outside of conservancy (past year)	12.2	180	3	16.1	0.07	16.7	10.4	0.65
Often interacts with migrants through social life or work	25.3	174	19.2	20.2	0.912	75	32.6	0.09
<b>Substance Use</b>								
Believes substance use is a common concern in their community	48.4	153	60.9	45.6	0.2	100	42.6	0.03
Family members ever used illegal drugs	5.5	181	10	2	0.05	0	10.9	0.4
Friends ever used illegal drugs	6.9	173	10	1	0.015	0	19.5	0.24
<b>Sexually transmitted infections (STIs)</b>								
Believes STIs are common health concern in their community	91.1	179	100	85.7	0.04	100	95.8	1
Ever diagnosed with an STD	4.3	181	6.1	2	0.26	40	7.1	0.081
<b>Currently reports having:</b>								
Genital/anal sores	6.3	190	12.5	3.1	0.063	66.7	4	0.001
Unusual genital discharge	5.8	182	12.9	5.3	0.222	40	2.1	0.021
Pain upon urination	9.7	190	16.1	10.9	0.434	40	4	0.037
Genital/anal warts	3.9	184	6.5	3.2	0.596	40	2	0.02
Swollen gland around genitals (males only)						40	4	0.037
At least one symptom of a sexually transmitted infection	15.8	203	33.3	21.8	0.22	66.7	7.4	<0.001
<b>Sexual Behaviors</b>								
Median age first had sex (IQR)	17 (15-20)	159	18 (16-21)	17 (16-20)	0.25	15 (15-20)	17 (15-20)	0.65
<b>Number of sex partners in past 6 mo</b>								
None	23.3	172	32.1	12	0.41	0	22	0.5
1 sex partner	55.8	172	50	34.3		40	46	
>1 sex partner	20.9	172	17.9	53.6		60	32	
Never used condom (past 6 months) b	60.8	130	57.9	64.8	0.58	33.3	56.8	0.43



resources, with a significantly greater proportion having a pit latrine, electricity and running water ( $p=0.01$ ,  $p<0.01$ , and  $p<0.01$  respectively) compared to HIV negative men (Table 1). However, for women, HIV infection was associated with not having livestock, having household members go hungry in the past year, and being less likely to frequent a Cuca shop - which is an unlicensed house/shop selling goods, including alcohol (Table 1).

While HIV was not associated with community of residence or distance from the trans-Zambezi highway, for men infection was marginally associated with interacting socially or through work with migrants, and HIV-positive women were more likely to report their spouse or regular sex partner being away from the conservancy during the day they were surveyed.

Self-reported illicit drug and alcohol use was low among the overall sample. Just 19.6% reported using alcohol, although this rose to 38.1% for men and hazardous drinking behaviors were common (among those who drank alcohol in the past 6 months: 55.6% reported having been injured due to drinking; 54.1% were unable to stop drinking despite wanting to stop; 52.8% felt like drinking first thing in the morning; 47.8% had five (four for women) or more drinks in one sitting; 55.6% skipped meals to drink; and 59.5% had times they were unable to remember the previous night due to drinking). Only two participants reported ever using an illicit drug (cocaine, marijuana, and inhalants). While self-reported illicit substance use was uncommon, HIV-positive men were more likely to cite substance use as being a problem in their community and HIV-positive females were more likely to report having friends and family members who had ever used drugs compared to HIV-negative females ( $p=0.04$ ).

All participants reported at least one lifetime sex partner, one-quarter reported more than one recent partner, and four women reported exchanging sex in the past 6-months. Fully 60% never used condoms with their recent sex partners, and 23% reported they would be suspicious if their partner wanted to use a condom. A statistically significant greater proportion of HIV-positive women believed that condoms take the pleasure out of sex, compared to HIV negative women ( $p=0.05$ ).

Self-reported Sexually Transmitted Disease (STD) symptoms were high for both female (17%) and male participants (13%). HIV-positive males had greater odds of reporting currently having genital/anal sores, unusual discharge, and pain upon urination, genital/anal warts or swollen glands around genitals compared to HIV-negative males.

**Access to services**

Almost 80% of HIV diagnoses during this study were new, as 57.4% of participants had never been tested for HIV. For those with prior testing, 69.8% were tested in a public clinic or hospital (0.9% of these as part of antenatal care) while 15.5% were tested through mobile outreach. Of those previously diagnosed HIV-positive, only 25% had ever taken Anti-retroviral (ART). Independent of HIV status, most participants had trouble obtaining condoms, with only 18.8% often or always able to get condoms when needed, and 28.1% able to afford condoms.

Although not directly related to HIV status, one third of participants had an unmet healthcare need in the past year, and only 5% of female participants ever had a women’s health exam. The most common barriers to general healthcare included cost (39.7%), too ill to travel to the clinic (36.2%), and transportation issues (17.2%).

**HIV knowledge and attitudes**

Basic knowledge of how HIV is transmitted was common, with approximately 90% correctly recognizing that HIV can be transmitted through sex without a condom and intravenous drug use. Most knew that HIV was not spread by coughing or sneezing (93%) or sharing meals (92%), and that a baby could contract HIV through breastfeeding (93%). However, misconceptions existed, with 30% believing there is no treatment for HIV and 22% believing mosquitoes/insects can transmit HIV. Despite high prevalence of HIV in this community - only 30.9% knew or had personally known someone with HIV/AIDS, perhaps reflective of hiding one’s serostatus to avoid stigma. A third believed that people contract HIV due to their own carelessness (36%). Two-thirds expressed great concern about potential stigmatization by friends and family if they had HIV, with a marginally greater proportion of HIV-positive men being extremely worried their friends would reject them ( $p=0.1$ ), compared to HIV-negative men.

**Independent associations with HIV**

All factors statistically significant at the  $p \leq 0.20$  level in bivariate

**Table 2:** Factors independently associated with HIV-positive serostatus among residents in rural Dzofi and Sobbe conservancies, Namibia, 2012 (n=203).

	OR	95% CI	p-value	AOR	95% CI	p-value
Reports currently having at least one STD sign or symptom	3.19	1.36-7.05	0.008	3.21	1.37-7.52	0.007
Female	2.81	1.11-8.11	0.029	2.51	1.00-6.47	0.056
Household does not own livestock	1.92	0.92-3.81	0.083	1.85	0.88-3.92	0.106

OR: Odds Ratio; AOR: Adjusted Odds Ratio based on multivariable model; CI: Confidence Interval



analysis were considered in the multivariable analysis. Factors remaining significant at the  $p \leq 0.10$  levels were retained in the final model (Table 2). Females had nearly three-fold increased odds of having HIV compared to males. Additionally, self-reporting STD symptoms and living in a household with no livestock was associated with infection.

## Discussion

As the range of HIV treatment and prevention campaigns has expanded following successes in other regions, accessing and engaging with difficult to reach rural areas have become an increasingly important component of the global HIV control strategy. The data presented here are from 2012 and represent an important baseline on which to build an understanding of the antecedents of more recent HIV prevalence and correlate studies from this largely under-studied region.

We found significant differences in both prevalence and correlates of HIV for men and women. We identified several potentially modifiable correlates, which may reflect some of the key drivers of transmission in this region at the time of data collection, and may still be contributing to the region's patterns of incidence and prevalence today.

Reflective of the broader HIV epidemic in sub-Saharan Africa, women in our study had a proportionally higher burden of HIV infection. A pooled sample of Demographic and Health surveys from 20 countries in sub-Saharan Africa showed that women had on average 60% higher risk of HIV infection compared to men, even after controlling for risk behaviors [17] and more recent work has demonstrated that these differences have persisted [18]. Among women, our highest prevalence group was women aged 35 to 45. In the most recent study published from this region (2014-2016), the demographic group with the highest incidence found over a 1.5-year period was adolescent girls and younger women aged 15 to 24, living in rural areas most similar to the conservancies we studied [14]. Since we studied prevalence and the more recent study evaluated incidence, we cannot directly compare results, but the trend toward peak infection age skewing younger over time is concerning. Regardless of the trend, the results of both studies suggest that interventions should target younger women in rural areas in order to impact both of these age groups. In addition to higher prevalence in females, we found different correlates of infection by sex. Thus, further work into addressing gendered differences and vulnerabilities - regarding things like economic opportunities, gender-based violence, and access to education and services - is necessary.

Perhaps reflective of the sex differences described above, we found HIV-positive men tended to live in households with greater resources, whereas HIV in women was associated with poorer economic conditions. Previous and subsequent findings regarding HIV and economics are mixed. Some have found increased HIV risk in higher Socioeconomic Status (SES) categories [19], while economic and food security - especially for women - is important for access to health resources. In a review of 36 studies in sub-Saharan Africa, 15 found no association between SES and HIV infection, 12 found HIV infection to be correlated with high SES, 8 found an association between low SES and HIV infection, and one was mixed [20]. Our study reflects this complex interaction between economics and HIV, where it appears that economic disparities by gender may be creating a power divide exacerbating the epidemic. Further study

into clarifying the relationships between gender, class, and HIV status are recommended, as these economic disparities and differential HIV associations may shed light on the reason for diverse findings on economics and HIV in other settings.

While a priori we hypothesized that HIV prevalence would be higher closer to the Trans-Zambezi highway, no statistically significant difference in prevalence was found. The HIV epidemic was clearly already well established in this region in 2012, so local geographic differences that may have been important for initial introduction of HIV in the area likely were no longer significant factors in transmission even a decade ago. Local geography may be of renewed importance once HIV prevention efforts reduce infection levels. Mobility has been linked to sexual risk taking, increased exposure to violence, and higher HIV prevalence. A study among 5,016 pregnant women in the Democratic Republic of Congo found mobility related to the profession of one's husband was associated with a 4-fold increased odds of HIV infection [21]. While local geography was not a significant HIV correlate in our study, not having a spouse or sexual partner in the conservancy at the time of the interview was associated with HIV infection in women and interacting with migrants was marginally associated with HIV-seropositivity in male participants.

Although alcohol use was lower than expected, it was more common among men and over half of drinkers reported hazardous drinking behaviors. We were also surprised to find some direct and indirect indications of "hard" illicit drug use, despite this being a very rural area. Such use of both alcohol and illicit drugs warrants continued monitoring, since the use of both have been connected to HIV incidence and transmission in previous studies [22-25].

Not surprisingly, given that some Sexually Transmitted Infections (STIs) facilitate HIV transmission, are an indicator of unprotected sex, and are more common in those with lower CD4 cell counts, HIV-seropositive status in our study was significantly associated with having a previous STI diagnosis or currently having an STD symptom. Testing and treating STIs - along with associated counseling on safer sex - may prove to be a cost-effective strategy in combating HIV, as in other settings [26-28].

While not directly associated with HIV in this study, access to healthcare and preventive services is an integral component to stemming HIV transmission. While HIV prevalence was high in Zambezi, previous testing was low in 2012, with most HIV cases being new diagnoses. Further, of those who knew they were HIV positive in 2012, few were taking ART. Since the conduct of this study, rates of ART treatment among PLWH have increased to 88% in Namibia [1], with a special focus on saturating the Zambezi region under the Namibian government's "Treat All" policy [29]. This PEPFAR-supported policy also aims to increase access to PrEP in the area and currently provides effective prophylaxis for an estimated 38,000 people in Namibia [30]. However, the distance needed to cover rural areas still presents a significant challenge to disseminating HIV prevention messages and care in Namibia and across the globe, and lessons in how to distribute treatment throughout remote regions effectively can be learned from the implementation of the "Treat All" policy. Furthermore, transportation or being too ill to travel to the doctor were cited as common reasons for having an unmet healthcare need when we surveyed this population. Similarly, a study of antenatal care in rural Uganda found that living more than 3 km from a health facility was associated with not being tested - regardless of SES [31]. In Kenya, a geospatial analysis found a 7% decrease in uptake of facility

delivery and accessing prevention of mother-to-child transmission services for every kilometer distance between maternal residence and the antenatal clinic [32]. However, reaching rural areas may not be as simple as increasing the number of health posts. A modeling study in rural KwaZulu-Natal South Africa found that increasing the number of available healthcare facilities for ART distribution ~ threefold did not lead to a threefold increase in treatment accessibility, with many areas still remaining outside of the catchment areas of clinic networks [33]. Based on our experience delivering mobile HIV testing in this environment, it might similarly require mobile clinics instead of more health centers to effectively distribute ART treatment, PrEP prophylaxis, and continued HIV testing throughout unreached remote regions. Especially in areas where options for transportation are limited and the economy is largely cashless (at least for elders), transportation costs represent a significant barrier to treatment. Condom distribution might also be an effective preventative strategy in isolated regions such as Zambezi.

Complicating the issue may be HIV-related stigma, which has led to delays in treatment seeking and less than optimal adherence in other settings, regardless of distance to services [34,35]. However, stigma surrounding condom use appears to have decreased in the area since the conduct of this study in 2012: While 60% of our participants never used condoms with recent sex partners, a more recent study found that 56.0% of women used a condom with their last partner and 8.5% used condoms consistently [14]. These data suggest that condom distribution and acceptance have successfully penetrated the region over the past decade.

Considering the high prevalence of HIV in women in our study, expanding HIV testing and care to women's health settings is imperative in this region. Only 5% of female participants had ever received a women's health exam, suggesting that mobile testing could also include women's health check-ups (STI screening and Pap smears). While we did not collect data on what percentage of women seek antenatal care during pregnancy, considering the low percentage of persons citing their last HIV test was in an antenatal care setting (<1%), this may represent an opportunity to expand access in this setting. In a study in rural Uganda, antenatal clinic attendance was high (96%), but only 64% were tested for HIV, 20% received HIV risk reduction counseling, and 4% were couple tested [31], suggesting that similar rural regions are likely faced with missed opportunities for testing and connecting to preventive services and care.

Due to the cross-sectional design of this study, we could not determine causality of associated variables. Sample size limitations also precluded us from calculating independent correlates of HIV status by sex. While we aimed to recruit a similar number of men and women, females comprised 70% of our sample. It was particularly difficult to get younger men to agree to be tested, which may speak to their heightened mobility and perhaps concerns about HIV stigma. This gender-skewed willingness to engage with the study is consistent with more recent HIV studies in the Zambezi region that also had difficulties recruiting and retaining male participants [14]. Although we worked with a local non-governmental organization that has built trust in this area in regard to their HIV prevention work, social desirability bias may have affected self-report of sexual, alcohol, and substance use risk activities. These data represent the first community estimates of HIV prevalence collected door-to-door in the Zambezi region. By investigating a wide range of primarily social and behavioral correlates, including socioeconomic status, drug use, attitudes

towards and ability to obtain condoms, and accessibility to women's health exams, we identified several potentially modifiable correlates of HIV infection that were consistent with local understanding of the HIV situation by the field team. This understanding could help inform control efforts in this and similar remote regions, while also providing contrast and comparison to the current HIV situation in rural Namibia.

## Conclusion

As the reach of HIV treatment and prevention campaigns expands following successes in some areas, more difficult to reach rural areas have become an increasingly important part of the HIV control strategy. Our study offers useful baseline prevalence data in the Zambezi region and identifies several behavioral and epidemiological correlates to HIV infection that continue to shape HIV transmission in a model rural setting. These correlates emphasize the necessity of expanding STI testing and treatment, widening education efforts to dispel misconceptions about HIV and decrease stigma, increasing access to free and affordable condoms, and making HIV testing and treatment more accessible through mobile clinics, especially for younger women who shoulder a disproportionate burden of HIV prevalence. Longer-term, structural goals, such as reducing economic disparities, may also play an important role in reducing HIV in this and similar settings.

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