Prevalence of sexually transmitted infections and co-infection rates with HIV among youth in Lesotho

L Corno, S Berman, M Bjorkman Nyqvist, J Svensson, D de Walque

Corresponding author information:
Damien de Walque, Development Research Group, The World Bank, 1818 H Street, NW, Washington, DC 20433, USA. Tel. 1 202 4732517, Fax: 1 202 6140234, E-mail: ddewalque@worldbank.org

Coauthors’ information:
1. Lucia Corno PhD, Centre for the Research and Analysis of migration (CReAM), University College London, Department of Economics, London, United Kingdom, Joint lead author.
5. Damien de Walque PhD, Development Research Group (DECRG), The World Bank, Washington DC, USA

Keywords/Phrases: HIV; sexually transmitted infections; Africa; Lesotho

Word Counts
Summary 30
Abstract 237
Text 2,931
Tables 3 (NB: See attached file)

Conflict of Interest Statement
All authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare that (1) LC, SB, MBN, JS, DdW have no support from any company for the submitted work; (2) LC, SB, MBN, JS, DdW have no relationships with any company that might have an interest in the submitted work in the previous 3 years; (3) their spouses, partners, or children have no financial relationships that may be relevant to the submitted work; and (4) LC, SB, MBN, JS, DdW have no non-financial interests that may be relevant to the submitted work.

SUMMARY
A 2010 biomarker data collection confirms Lesotho is highly affected by the HIV pandemic. Trichomonas and Syphilis are very common, especially among women, and are prevalent among HIV positive individuals.
ABSTRACT

Background: To provide evidence on HIV and other sexually transmitted infection prevalence in Lesotho, and to examine co-infection rates and the association with individual socio-economic characteristics.

Methods: Socio-demographic and biomarker data were collected in 2010 from 3465 male and female youth between the ages of 18 and 30 in 30 rural and peri-urban villages in Lesotho. HIV and syphilis data were gathered using finger-prick rapid testing. *Trichomonas vaginalis* prevalence was recorded using vaginal swabs rapid test among women and microscopic identification from urine or genital discharge among men.

Results: In this study, 18.5% of female respondents and 7.9% of male respondents were HIV positive, with the highest prevalence recorded among widow/widowers and divorced individuals and females and males with no formal education. STI testing reveals a high prevalence of trichomoniasis (10.3%), especially among women (13.7%) and widows/ers (26.5%). Further, those who tested positive for STIs were more likely to have HIV. After adjustment for potential confounding factors trichomoniasis is associated with a 2.67-fold increased risk of HIV for females (CI 2.01-3.55, p-value<0.001), and syphilis is associated with a 4.63-fold increased risk of HIV for men (CI 1.74-12.29, p-value<0.001) and a 3.73-fold (CI 2.44-5.69, p-value<0.001) increased risk of HIV for women.

Conclusions: This study confirms that Lesotho is one of the countries with the highest HIV prevalence in the world and adds useful information about high prevalence rates for STIs and co-infection rates between those STIs and HIV.
BACKGROUND

Despite localized successes in preventing new infections, the HIV/AIDS epidemic continues to threaten citizens throughout sub-Saharan Africa. The epidemic is especially acute in Lesotho where Demographic and Health Survey (DHS) results place HIV prevalence at 23% for the adult population, the third highest prevalence in the world[1]. Despite varied and on-going initiatives throughout the country, HIV prevalence in Lesotho has remained consistently high since 2004[2]. With nearly one quarter of the population infected and the incidence of new infections holding steady, it is crucial to identify the most common risk factors associated with HIV infection and to make sure they are the focus of prevention activities.

The current body of scientific literature recognizes that sexually transmitted infections (STIs) are one of the strongest risk factors for HIV infection, facilitating transmission of the virus. STIs facilitate HIV infection by breaching protective mucosal barriers and causing genital bleeding, further increasing the risk of exposure to HIV during sexual activity[3]. Previous research in developed and developing countries, but not in Lesotho, has reported that STI infections are positively associated with higher HIV infection and acquisition[4-6]. For example, McClelland, et al. (2007) show, among a sample of women in Kenya, that *Trichomonas vaginalis* infection is associated with a 1.52 fold (95% confidence interval, 1.04-2.24 fold) increased risk of HIV-1 acquisition after adjustment for potential confounding factors[7]. However, Galárraga et al. (2009), summarize that while the earliest study on the efficacy of STI treatment as a method of HIV prevention reports nearly a 40% decline in HIV infection over a 2 year period in Tanzania[8], no other randomized control trial has yet replicated those results[9].

Although the Government of Lesotho has collected and reported nationally representative data on HIV prevalence via DHS surveys in 2004 and 2009, to-date few studies have reported the prevalence of other STIs in Lesotho. The only available study, using data from 1995, found a prevalence of 28.4% for chlamydia, 5.9% for gonorrhea, 11.3% for syphilis and 6.3% for HIV among a random sample of about 526 individuals in a rural community in the Lesotho highlands [10]. Except for HIV prevalence, which has evolved dramatically since 1995, more recent prevalence measures do not seem to have been reported. STI testing is particularly important since some STIs are asymptomatic and yet carry serious health consequences, specifically in countries with high HIV prevalence. This paper provides initial evidence on STI infection (syphilis, *Trichomonas vaginalis*) and co-infections with HIV among youth living in rural Lesotho. In light of the known concurrency between HIV and STIs, results of this study may be informative as Lesotho’s Ministry of Health and non-governmental organizations (NGOs) continue to plan and implement nationwide prevention strategies.

MATERIALS AND METHODS

Data
Between February and April 2010, we conducted a cross-sectional behavioral and demographic survey accompanied by HIV and STI testing among a sample of youth who resided in 30 rural and peri-urban villages in 5 out of 10 districts in Lesotho; Butha-Buthe, Leribe, Berea, Maseru, and Mafeteng. Thirty villages were randomly selected from the list of villages recorded in the 2006 Census. To be eligible to participate in the survey, individuals had to be between 18-30 years old and give verbal informed consent. The final sample includes 2355 women and 1110 men, approximately 51% of the eligible individuals in the selected villages. Individuals were recruited to participate through a variety of channels. First, a community liaison officer from the implementing NGO visited each participating community to garner support from village leadership for the project. The village chief was requested to hold a town meeting to introduce the field teams and the aim of the survey. A nurse was present at this meeting to field individual questions. Second, social media channels were utilized in the form of mass text messaging and daily radio announcements.

Two teams of four certified nursing assistants (2 males and 2 females) administered behavioral surveys and STI and HIV clinical testing to all participants. The survey and the HIV and STI tests were joined by pre- and post-test counseling. To increase accessibility to participants, nurse enumerator teams were housed within the communities for a week and were available to see patients before and after work hours. Team nurses provided test results to each participant immediately after the survey questionnaire in tents used as mobile clinics. Individuals who tested positive for STIs were treated with antibiotics. For their participation in the survey and clinical tests, every participant received an in-kind incentive (candles, matches, and washing powder), worth approximately 3USD.

The behavioral survey includes 19 sections investigating socio-economic characteristics, sexual attitudes and behaviors, and knowledge about HIV/AIDS and STIs. This paper will focus on HIV and STI prevalence, co-infection rates, and their association with individual socio-economic characteristics.

The biological markers used in this study have been selected from a list of curable STIs that are commonly used within the epidemiological literature as proxies for risky sexual behavior and have high co-infection rates with HIV. In particular, STIs which have the greatest impact on HIV transmission are those that produce genital ulcers and urethral/vaginal discharge, such as syphilis, gonorrhea, chlamydia, HSV-2, trichomoniasis[3, 11]. Every participant was tested for HIV, syphilis, and trichomoniasis, chosen to represent curable sexually transmitted infections with available rapid tests, and to fit within budget restraints. HIV and syphilis testing was done with rapid blood tests, while trichomoniasis tests were done with genital swabs.

Male participants were tested for Trichomoniasias with the InPouch™ TV [12] manufactured by Biomed Diagnostics. The test provides a system for microscopic identification from urine or
Female participants were tested for *Trichomonas vaginalis* using the OSOM® Trichomonas Rapid Test[13]. The OSOM® Trichomonas Rapid Test is an immunochromatographic assay that detects pathogen antigens directly from vaginal swabs. Both male and female participants were tested using the SD BIOLINE Syphilis 3.0 Rapid Blood Test[14].

Nurses and participants were not blinded to the STI results as the protocol included provision of treatment for all participants who tested positive for *Trichomonas vaginalis*, and syphilis. Male and female condoms were available, at no cost, to all participants at the end of the visit.

All participants were also tested for HIV based on Lesotho national testing guidelines. First line testing was completed using the Determine™ HIV-1/2 rapid test[15]. If the result was negative, the participant was considered HIV negative and was recommended to return for repeat testing in 3 months. If the participant tested positive, he or she was given a second rapid test using the DoubleCheckGold™ HIV 1&2 test[16]. Once the participant received a second, confirmatory test, he or she was considered HIV positive. If, however, the second test was negative after an initial positive result, a third test was done for verification. The third test used is the Uni-Gold™ Recombigen® HIV. All participants who tested positive were referred to the nearest health clinic for appropriate follow-up.

**Analysis**

The analysis is mainly based on descriptive statistics, showing cross-tabulations between HIV and STI prevalence and socio-demographic characteristics (age, education, marital status), and level of wealth, proxied by the amount and type of durable goods held by the household. In addition, we investigate co-infection rates between STI and HIV positive youth. Finally, we use a logistic regression to compute estimated adjusted odds ratio and assess the risk of HIV given STI infections. We used Stata 11.0, for statistical analysis[17].

**RESULTS**

**HIV and STI prevalence**

A total of 2355 women and 1110 men participated in the survey. HIV test results were obtained from 3419 individuals (98.7% of the sample), 2320 women and 1099 men. Participation in this survey was conditional on informed verbal consent to be tested for both HIV and STIs. As a result, while the refusal rate for testing is zero, logistical issues such as minor stock outs, prevented a few individuals from testing. The prevalence of HIV and sexually transmitted infections is given in table 1.

Results show that in our sample, 18.5% of women (CI 16.9-20.1) and 7.9% of men (CI 6.3- 9.5) are HIV positive. The mean test rejects the equality of means with a p-value of 0.000. While syphilis was not extremely common, the prevalence of trichomoniais is fairly high. Only 3.8%
of the respondents tested for syphilis (99.5% of the sample) were positive and this prevalence is higher among women (4.5%, CI 3.7-5.4) than men (2.4%, CI 1.5-3.6). Trichomoniasis is the most common sexually transmitted infection in our study population: among those tested (94.5% of the sample), 10.3% were trichomoniasis positive, with a higher prevalence of positive women (13.7%, CI 12.3-15.2) compared to men (3.4%, CI 2.3-4.4).

Co-infection rates
The study focuses on testing STIs which may have an impact on HIV shedding, specifically syphilis and trichomoniasis.

Table 2 reports HIV prevalence among respondents who tested positive for trichomoniasis and syphilis. As expected, HIV infection rate is higher among individuals who are trichomoniasis or syphilis positive. For example, among women infected with syphilis, 45.1% (CI 35.4-54.9) are also HIV-positive, compared to 17.2% (CI 15.6-18.8) among women who are negative for syphilis. Among men who tested positive for syphilis, 34.6% (CI 15.1-54.2) tested positive for HIV, compared to 7.2% (CI 5.6-8.7) among men who are not infected with syphilis. Table 2 also shows that among women who tested positive for trichomoniasis, 34.3% (CI 28.9-39.8) are infected with HIV, compared to 15.9% (CI 14.3-17.6) among women who are trichomoniasis negative. In the sample of men, HIV is recorded for 19.4% (CI 5.8-33.0) of the trichomoniasis positive individuals and for 7.4% (CI 5.7-8.9) among those trichomoniasis negative.

Furthermore, after adjustment for potential confounding factors (age, education, residential area), trichomoniasis is associated with a 2.67-fold increased risk of HIV for females (CI 2.01-3.55, p-value<0.001) while there is no statistically significant correlation in the sample of men. Syphilis is associated with a 4.63-fold increased risk of HIV for men (CI 1.74-12.29, p-value<0.001) while it is associated with a 3.73-fold (CI 2.44 - 5.69, p-value<0.001) increased risk of HIV for females (not displayed).

HIV and STI prevalence by selected characteristics
Table 3 displays the variation in HIV and STI rates for women and men, by a set of socioeconomic characteristics. Among both genders, HIV, syphilis and trichomoniasis prevalence monotonically increase with age, reaching the peak among respondents 27-30 years old. HIV prevalence is higher among women in the 27-30 age group compared to those in the 18-23 age group (30.7% versus 10.5%, p-value<0.001) and a similar trend is reported in the sample of males (21.6% versus 1.7%, p-value<0.001). In the same age group, syphilis has been recorded for 4.9% of women and for 3.6% of men, but the difference across age is statistically significant only in the male sample. Trichomoniasis is higher for women aged 27-30 years (14.7%), but without a statistically significant difference between age groups. Among men of the same age, 6.1% are trichomoniasis positive compared to 2.3% among the youngest (p-value<0.01).
HIV and STI prevalence are closely related to marital status. HIV infection rates are greater among widow/ers and divorced or separated individuals. The HIV prevalence rate is 45.8% among widows and 31.6% among divorced or separated women compared to 15% among single women \((p\text{-value}<0.01)\). The corresponding figures in the sample of males are equal to 100%, 38.5% and 3.9%, respectively, and, although the number of observations was small, they remain statistically significant at 1% level. Once again, syphilis prevalence is higher for widows and widowers (6.3% and 2.5% respectively) and it decreases for currently married individuals and for singles, but these differences are not statistically significant. Finally, trichomoniasis is greater among women than men for all marital status categories. Trichomoniasis prevalence among widows is 28.9%, while there are no infected widowers in our sample. The positive association between widowhood and divorce and STI infection could also be driven by the positive association between STI infection and age.

In our sample, education seems to be inversely related to infection. 30% of female respondents with no formal education are HIV-positive and this prevalence decreases with primary education (23.3%), secondary education (14.5%; \(p\text{-value}<0.01\)), and further with tertiary education, where only 10.2% \((p\text{-value}<0.05)\) of women are HIV infected. A similar trend is reported in the sample among males, where the share of HIV positive with primary education and secondary education is equal to 10% and 5.3% respectively, compared to 22.6% for those with no formal education \((p\text{-value}<0.05 \text{ and } p\text{-value}<0.01, \text{ respectively})\). Similar trends were noted among men and women with respect to syphilis and trichomoniasis infections.

As a proxy for wealth, we constructed an index from 0 to 8, by summing up a list of durable goods held by the household (car, electricity, mobile phone, paraffin lamp, radio, fridge, scooter, television). There is little variation between HIV status and wealth for women, while in the sample of men the percent HIV positive is lower among the most wealthy (5.8%) compared to the least wealthy (15.7%) \((p\text{-value}<0.001)\). There is very low discrepancy across wealth categories for syphilis among women, while, once again, syphilis prevalence is statistically significantly lower among wealthier men compared to those in the lowest part of the income distribution \((p\text{-value}<0.05)\). The lowest trichomoniasis infection rates are recorded among the wealthiest women (10.4%) compared to the poorest (17.5%) \((p\text{-value}<0.05)\), while the differences across wealth indicators among male respondents is low and not statistically significant.

**DISCUSSION**

The 2009 DHS places Lesotho third worldwide for the highest overall adult prevalence of HIV, at 23%. HIV prevalence among youth 18-30 years old is reported to be 17.8%; 23.2% of women and 10.8% of men. Our study results are consistent with the above most recent DHS estimates: 15.1% tested positive for HIV; 18.5% of women and 8% of men. A systematic analysis of important characteristics that are correlated with HIV (such as education, age, and residential
location) reported from our study and in the DHS survey further reveals sample group similarities. However, this study also reveals a high prevalence of STIs among our sample of youth in Lesotho; data not previously collected by the Demographic and Health Survey.

Participation criteria for this study were to be between the ages of 18 and 30 and to provide informed consent before testing. The prevalence we found may be low on account of self selection bias; those eligible individuals who were either already aware of their positive status or who were not interested in knowing their status, simply may not have tested. The sample of those individuals who agreed to participate is therefore not random. In this respect, it is important to note that while recruitment was lower among males (N=1110) than among females (N=2355) who were more willing to participate, our HIV results are not significantly different than for the relevant age groups in the DHS 2009. If infected men were less willing to participate than infected women, this might partially account for the lower prevalence found among males. While every effort was made to include all eligible individuals in each village, participation was not mandatory and this we acknowledge as a study limitation. In an effort to reduce selective sampling error from individuals who might have been discouraged by mandatory HIV testing and status disclosure it was encouraged, though ultimately optional, to receive the results of the HIV tests.

The data presented in this paper were collected as part of a baseline survey for a randomized controlled trial on the effectiveness of short-term financial incentives, coupled with testing and treatment, to reduce transmission of treatable STIs among youth in rural and peri-urban settings. The results reported in this paper add to the knowledge about STI prevalence in Lesotho, but include only two curable STIs that could easily be tested with rapid tests. Further research shedding light on the prevalence of other STIs, such as gonorrhea, chlamydia and genital herpes, would be important to have a more complete picture about STIs prevalence in Lesotho.

In this study, the largest difference in HIV and STI prevalence was found across genders. The percentage of HIV-positive women (18.5%) was more than double that of HIV-positive men (7.9%). Similar results were found among the trichomoniasis positive respondents (10.3%), with 13.7% women infected, and only 3.4% men. It should be noted that the method of sample collection was different between genders for the Trichomoniasis tests. The discrepancy of HIV and STI prevalence between men and women is common in other sub-Saharan African countries, suggesting on one hand, the higher biological probability of transmission from men to women than from women to men and on the other, a disparity potentially due to sociological factors including economic resources and power differentials in sexual relationships.

Our results present a clear inverse relationship between education and HIV and STI infection rates, amongst individuals with no formal education 27% are HIV positive, and 18% are infected with trichomoniasis. Of participants with tertiary education 6.3% are HIV positive and 3.1%
tested positive for trichomoniasis. Early literature presents HIV as a virus that inversely affected
the most educated in a population[18]. However, our results reflect the conclusions of more
recent articles which show that higher prevalence of HIV is now shifting towards those with less
education[19].

Co-infection rates between HIV and STIs are statistically significant, especially among women.
Our data show a 2.67-fold (CI 2.01-3.55, p-value<0.001) increased risk of HIV for women who
are trichomoniasis positive and a 3.73-fold (CI 2.44- 5.69, p-value<0.001) increased risk for
those who are diagnosed with syphilis. Men who are syphilis positive have a 4.63-fold (CI 1.74-
12.29, p-value<0.001) increased risk of HIV. Moreover, the health risks of STI co-infections in
immune-compromised, HIV-positive individuals are extremely high and this is particularly
relevant in a country so devastated by the HIV pandemic as Lesotho.

ACKNOWLEDGEMENTS
We acknowledge Population Service International (PSI), especially Dennis Walo, Hope
Hempstone, Mosele Machitje, and Karen Banda, and LEADs Consultancy, especially Elisa
Maffioli and Fidelis Enesor, for the survey implementation, collection of the biomarker data,
and data cleaning. We are grateful to Adam Wagstaff for very useful comments.

FUNDING
This study was funded by the following trust funds managed by the World Bank: the Strategic
Impact Evaluation Fund (SIEF), the Bank Netherlands Partnership Program (BNPP) and the
Trust Fund for Environmentally and Socially Sustainable Development (TFESSD).

ETHICAL APPROVAL
Approval for this study was obtained from the Ethics Committee at the Ministry of Health and
Social Welfare in Lesotho and the Instituto dei Tumori Hospital Ethic Committee in Italy.
REFERENCES


12 InPouch™ TV manufactured by Biomed Diagnostics. White City, OR, USA.

13 OSOM® Trichomonas Rapid Test. Genzyme Diagnostics, San Diego, CA USA.


16 DoubleCheckGold™ HIV 1&2 Test. Orgenics. Yavne, Israel.

17 Stata. Version 11.0, Statistics/Data Analysis, 4905 Lakeway Drive  College Station, Texas, USA: StataCorp, 1984-2009.


TABLES

See attached file.