

# Age, poverty and alcohol use as HIV risk factors for women in Mongu, Zambia

\*Singh K<sup>1</sup>, Buckner B<sup>1</sup>, Tate J<sup>2</sup>, Ndubani P<sup>3</sup>, Kamwanga J<sup>3</sup>

1. MEASURE Evaluation, University of North Carolina at Chapel Hill, Chapel Hill, NC

2. Division of Viral Disease, Centers for Disease Control and Prevention, Atlanta, GA

3. Frontiers Development and Research Group, Lusaka, Zambia

## Abstract

**Background:** Age, poverty and alcohol use are seen as risk factors for HIV among women in sub-Saharan Africa.

**Objective:** The objective of this study was to understand the influence of socioeconomic factors (including age and poverty) as well as alcohol use on risky sexual behaviors among women in Mongu, Zambia.

**Methods:** This study examines these factors in the local context of Mongu, Zambia using the Priorities for Local AIDS Control Efforts (PLACE) methodology. This methodology allows for the study of risky behaviors while taking into consideration local factors. The two outcome variables studied were transactional sex in the past year and having two or more sexual partners in the past year.

**Results:** In this study age was not a significant factor, but alcohol use and poverty/desire for economic advancement were significant factors.

**Conclusion:** Programs and policies need to address the influence of alcohol on risky sexual behaviors and also the important but complex influence of poverty.

**Key Words:** HIV, poverty, alcohol, young women, and Zambia

*African Health Sciences* 2011; 11(2): 204 - 210

## Introduction

In Sub-Saharan Africa women account for nearly 60% of HIV infections<sup>1</sup>. Studies have suggested that age, alcohol and poverty use are HIV risk factors for women in sub-Saharan Africa.

Young people, particularly girls and young women, aged 15-24 are at high risk for acquiring HIV in sub-Saharan Africa and account for 45% of new infections. Prevalence rates for girls and young women are particularly high in Southern Africa with rates of 22.6% for Swaziland, 12.7% for South Africa and 11.3% for Zambia<sup>1</sup>. Adolescent girls and young women are at much greater risk of acquiring HIV than their male counterparts. In countries such as Cote d'Ivoire and Kenya for every young man 18-24 infected with HIV there are five young women 18-24<sup>2</sup>.

The link between alcohol use and HIV has been established in the research literature. A study

of women in Tanzania found that women who were drinkers had an increased risk (AOR=2.10) of being HIV positive than women who were nondrinkers. The study further found that problem drinkers had increased risks compared to nonproblem drinkers suggesting a dose response relationship between alcohol consumption and HIV<sup>3</sup>. A review of the association between alcohol use and HIV in Africa found that drinkers (men and women combined) had a 57% increased risk of HIV infection after controlling for confounders compared to nondrinkers<sup>4</sup>. Another review of alcohol use and risks for HIV found that there was a gender difference regarding alcohol use. Men were more likely to drink and engage in high risk sex while women's risks were linked to their partners' drinking rather than their own drinking<sup>5</sup>. A study of youth 15-21 sampled at drinking establishments in Zimbabwe found evidence of risky behavior associated with alcohol use. In that study 42% of women had sex under the influence of alcohol in the past 90 days, 60% had met a sexual partner at a drinking establishment and 63% had received money for sex in the past 90 days<sup>6</sup>.

Poverty's role in HIV might be more two-sided. Shelton<sup>7</sup> has indicated that both wealth and economic disadvantage may play pivotal roles in HIV

### \*Correspondence author

Kavita Singh

CB# 8120

University of North Carolina at Chapel Hill

Chapel Hill, NC 27516

United States

Telephone number: 919-933-9426

Fax number: 919-966-2391

Email: [kavita\\_singh@unc.edu](mailto:kavita_singh@unc.edu)

transmission. Poverty may drive some women into risky sexual behaviors such as transactional sex, and on the otherhand wealth may enable women to have multiple partners because of more mobility and social interactions. Another issue is that a desire for economic advancement may sometimes be a key factor rather than economic disadvantage itself. Mishra et al<sup>8</sup> examined the association between household wealth and HIV in eight sub-Saharan African countries (Burkina Faso, Cameroon, Ghana, Kenya, Lesotho, Malawi, Tanzania and Uganda). In all the countries adults in the wealthiest quintiles had a higher prevalence of HIV. Nattrass<sup>9</sup> found that though poverty may be a key factor in the HIV epidemic in some countries, its impact is overshadowed by contextual factors – both social and behavioral factors. Using data from the 2003/2004 Tanzania HIV/AIDS Indicator Survey, Msisha et al.<sup>10</sup> found that women of high socio-economic status had a higher probability of higher HIV than those of low socioeconomic status. Women in professional jobs had an odds ratio of 1.54 compared to women who were unemployed.

This study explores the associations of age, alcohol use and poverty with two risk factors for HIV – multiple partners and transactional sex in the context of Mongu, Zambia. In Zambia women account for 57% of individuals infected by HIV<sup>1</sup>, and HIV prevalence is 16% for women and 12% for men<sup>11</sup>. The Priorities for Local AIDS Control Efforts (PLACE) method was used to understand HIV risks for women in the town of Mongu, Zambia. Exploring these important factors within a local context is so important because it can be said that HIV is a global epidemic comprising of many local epidemics<sup>12</sup>. Understanding these local epidemics is paramount to making progress in combating the overall HIV epidemic<sup>13</sup>.

The PLACE method was developed with respect to data needs for program planning and monitoring at a local level. Because of limited resources, there is a need to focus HIV interventions where they will be most effective. Epidemiological theory indicates a crucial role for those areas where HIV transmission is mostly likely to occur – high transmission areas (HTAs) or priority prevention areas (PPAs). The PLACE method is a monitoring tool to identify PPAs and specific venues within them where HIV/AIDS prevention programs should be focused<sup>12</sup>. The first step of the PLACE method is to use available data and contextual information to identify a PPA. The next steps use rapid field

methods to identify and describe venues within these areas where people meet new sexual partners and where prevention interventions would be most needed. The focus is on new partners because individuals with high rates of new partner acquisition may be more likely to transmit the infection. Likewise individuals with newly acquired HIV may be more infectious<sup>14</sup>. The PLACE method also obtains characteristics of people socializing at the venues. Obtaining these characteristics is important in understanding if there are individual factors associated with risky sexual behaviors.

## Methods

Mongu was selected as a PPA because of data indicating high HIV prevalence. Data from antenatal clinics indicated a prevalence of 28.2% in 2004 for the city of Mongu, and an overall prevalence of 21% for Mongu District<sup>15</sup>. Urban Mongu is a provincial capital which serves as a crossroads for commerce and trade. Large numbers of people – business men, tradesmen, migrants and tourists meet and socialize with each other and mix with the local population. Such mixing can create opportunities for HIV transmission. Mongu District is also home to fish camps along the Zambezi River where women from different parts of Zambia come to buy fish from male fisherman.

The PLACE method consists of three phases of fieldwork. In the first phase, interviewers ask community informants to list the public venues where people in that area meet new sexual partners. Community informants are individuals who live and/or work in that particular area. They are selected by convenience in public places in the study area. In Mongu 172 unique and operational venues were identified as places where people meet new sexual partners. (A few venues that were mentioned had been closed or where duplicate names for the same venue.)

In the next step interviewers visit the venues listed in the study area and conduct an interview with a venue representative, such as an owner or manager. Characteristics of the venue and of the people who socialize at that venue are obtained. In Mongu an interview with a venue representative was conducted at 149 of the 172 venues. Eleven of the venues were closed temporarily at the time the interviewer visited. In five cases the venue could not be found. In six cases the venue was found but there was no willing respondent. In one case it was not documented why an interview was not conducted.

During the third phase of fieldwork individuals socializing at a sample of the venues are interviewed regarding their sociodemographic characteristics, as well as their new sexual partnerships. In Mongu interviews were completed with 636 men and 343 women who were socializing at 39 of the selected venues. Only 2% of individuals approached for an interview declined to participate. The 39 venues were selected using a systematic fixed interval sampling strategy with the probability of selection proportional to the size of the venue. In this sampling strategy venues are listed by geographic code and by size. The size of the venue was determined by the number of people socializing at the venue during a busy time as reported by the venue representatives. Large venues have the potential to be selected more than once if their cluster code number was larger than the selection interval. The systematic fixed interval sampling strategy produces a self-weighted sample which gives each individual socializing at eligible venues an equal probability for the selection of an individual interview. The sampling strategy allows venues to be geographically distributed within a PPA. Up to twenty four interviews were conducted at most of the middle to small sized venues. In some of the larger venues more than one cluster of 24 individuals were interviewed.

A full description of the PLACE methodology can be found in the PLACE manual<sup>12</sup>. A full technical report of the findings from the Mongu PLACE study is also available<sup>16</sup>. This particular paper includes analysis not included in the Mongu technical report and is focused on understanding covariates of risky sexual behavior among women in Mongu, Zambia.

Covariates studied were age, employment, education, marital status, alcohol consumption, place of residence, length of time at current residence, and type of venue. Age is stratified into two groups 18-24 and 25+ to see if young women have riskier behaviors than older women. The employment variable has three categories – employed full or part-time, not employed/looking for work and not employed/not looking for work. The not employed/looking for work variable gives an indication of a desire for economic advancement or perhaps a desire just to get out of poverty. Education is categorized as none or primary and secondary or higher. Marital status is classified as currently married or currently not married. Alcohol consumption in the past 3 days is described as none,

1-2 days, 3-5 days, 6-10 days, and 11 or more days to study the effects of dose-response. Place of residence was classified as within or outside the geographic boundary of urban Mongu. Length of time at current residence was categorized as less than 1 year, 1-5 years, 6-10 years, 11-15 years, and 16 or more years.

Venues are classified into nightlife/drinking (eating/drinking/dancing/sleeping), open/transport related (transportation, public and commercial areas), events/private or hidden sites (concerts, sports events, tea parties, weddings) and fishing camps. The nightlife/drinking sites tend to be places where alcohol is consumed or where people tend to meet at night. The open/transport-related sites are typical commercial centers – markets and shops, places associated with transportation and churches and schools. The events/private or hidden sites are categorized together because they tend to occur in private locations and are not open to the public. Events are open to the public only with the purchase of a ticket. Fishing camps are unique to Mongu. Understanding if individuals with the riskiest sexual behaviors tend to socialize in particular types of venues is important to designing appropriate prevention programs.

Two outcome variables are studied – transactional sex, defined as giving or receiving money in exchange for sex, in the past year, and having two or more partners in the past year. These variables are both indicators of risky sexual behavior that can lead to HIV transmission.

## Results

Results of the bivariate and multivariate analyses of transactional sex in the past year are presented in Table 1. Women in the nightlife/drinking site had an odds ratio of 3.56 (95% CI 1.71–7.42,  $p < 0.01$ ) compared to women in the Open/Transport related sites. Also significant for women were being unemployed and looking for work, having secondary education or higher, having drunk alcohol in the past 30 days (a dose-response effect is evident), residing outside the urban Mongu boundary, and living at current residence for less than 1 year compared to 1-5 years and 6-10 years. Being currently single (not currently married or living with a partner) was also significantly associated with transactional sex in the past year (OR 3.50, 95% CI 2.05–5.95,  $p < 0.01$ ).

In the multivariate analysis age and education are not significant factors. Women at the nightlife/

drinking sites have an odds ratio of 3.07 (95% CI 1.18–7.98,  $p < 0.10$ ) while women at the fishing camps have an odds ratio of 4.10 (95% CI 1.14–14.77,  $p < 0.10$ ). Interesting fishing camps were not significant in the bivariate analysis but after controlling for other covariates, this becomes an important variable though only significant at  $p < 0.10$ . Not being employed and looking for work is strongly

associated with transactional sex in the past year with an odds ratio of 4.26 (95% CI 2.12–8.56,  $p < 0.01$ ). Those who are single had an odds ratio of 2.95 (95% CI 1.42–6.12,  $p < 0.01$ ) compared to women who are married. Consumption of alcohol in the past 30 days is strongly associated with transactional sex in a dose-dependent manner.

**Table 1: Bivariate and multivariate analysis of transaction sex in the past year**

Covariate	N	Bivariate Analysis			Multivariate Analysis (n=327)		
		Odds Ratio	Std. Err.	95% CI	Odds Ratio	Std. Err.	95% CI
<b>Age</b>							
18-24	202	1.34	0.29	0.88 - 2.03	1.10	0.36	0.58 - 2.09
25+	157	1.00	-	-	1.00	-	-
<b>Venue</b>							
Nightlife/drinking	240	3.56***	1.33	1.71 - 7.42	3.07*	1.50	1.18 - 7.98
Open/transport-related	42	1.00	-	-	1.00	-	-
Events/private or hidden	21	0.88	0.55	0.26 - 2.97	0.75	0.72	0.16 - 3.64
Fishing camps	57	1.52	0.68	0.63 - 3.66	4.10*	2.68	1.14 - 4.77
<b>Employment</b>							
Employed full/part time	99	1.00	-	-	1.00	-	-
Not employed and looking	141	3.70***	1.02	2.15 - 6.37	4.26***	1.52	2.12 - 8.56
Not employed and not looking	114	0.99	0.29	0.56 - 1.75	1.23	0.46	0.59 - 2.57
<b>Highest level of education completed</b>							
None or primary	139	1.00	-	-	1.00	-	-
Secondary+	216	1.57**	0.34	1.02 - 2.41	1.30	0.43	0.68 - 2.50
<b>Currently married/living with partner</b>							
Yes	90	1.00	-	-	1.00	-	-
No	264	3.50***	0.95	2.05 - 5.95	2.95***	1.10	1.42 - 6.12
<b>Alcohol consumption in past 30 days</b>							
None	174	1.00	-	-	1.00	-	-
1-2 days	54	2.87***	0.92	1.52 - 5.39	3.73***	1.45	1.74 - 8.00
3-5 days	59	8.41***	2.91	4.27 - 16.55	7.10***	3.00	3.10 - 16.24
6-10 days	50	8.16***	2.99	3.98 - 16.72	7.73***	3.64	3.08 - 19.44
11+ days	17	9.32***	5.57	2.89 - 30.05	8.09***	5.54	2.12 - 30.95
<b>Residence</b>							
Outside Mongu	146	1.00	-	-	1.00	-	-
Within Mongu	203	0.39***	0.09	0.25 - 0.60	0.59	0.21	0.30 - 1.17
<b>Years residing at current residence</b>							
Less than 1 year	60	1.00	-	-	1.00	-	-
1-5 years	141	0.34***	0.12	0.17 - 0.67	0.36*	0.17	0.14 - 0.90
6-10 years	56	0.61*	0.17	0.35 - 1.05	0.59	0.22	0.29 - 1.22
11-15 years	9	0.58	0.20	0.30 - 1.15	0.88	0.40	0.36 - 2.17
16+ years	87	0.34	0.25	0.08 - 1.44	0.46	0.46	0.06 - 3.27

\* $p < 0.10$  \*\* $p < 0.05$  \*\*\* $p < 0.01$

Results of the bivariate and multivariate analyses of two or more partners in the past year are presented in Table 2. The same factors that were significant for transactional sex in the past year are also significant for having two or more partners in the past year. The odds ratio for 6-10 days of alcohol consumption in the past 30 days was particularly high at 17.20 (95% CI 8.09–36.58,  $p < 0.01$ ). Respondents at the

nightlife/drinking sites had a higher odds of two or more partners in the past year but this association was not as strong (OR 1.94, 95% CI 0.96–3.96,  $p < 0.10$ ). Living at the current residence for less than 1 year was only significant when compared to 1-5 years and not as strongly (OR 0.44, 95% CI 0.22–0.87,  $p < 0.05$ ).

In the multivariate analysis of two or more partners in the past year age, venue and education are not significantly associated with the outcome. Factors that are significant are being unemployed and looking

for work, being single, having consumed alcohol in the past thirty days, and residing outside of urban Mongu

**Table 2: Bivariate and multivariate analysis of two or more partners in the past year**

Covariate	N	Bivariate Analysis			Multivariate Analysis (n=332)		
		Odds Ratio	Std. Err.	95% CI	Odds Ratio	Ratio Err.	95% CI
<b>Age</b>							
18-24	207	1.03	0.22	0.67 – 1.57	0.88	0.30	0.45 – 1.70
25+	159	1.00	-	-	1.00	-	-
<b>Venue</b>							
Nightlife/drinking	245	1.94*	0.69	0.96 – 3.91	0.84	0.40	0.33 – 2.12
Open/transport-related	42	1.00	-	-	1.00	-	-
Events/private or hidden	23	0.62	0.38	0.19 – 2.03	0.59	0.43	0.14 – 2.46
Fishing Camps	57	0.59	0.28	0.24 – 1.48	0.94	0.63	0.26 – 3.47
<b>Employment</b>							
Employed full/part time	100	1.00	-	-	1.00	-	-
Not employed and looking	145	2.59**	0.71	1.52 – 4.42	2.38*	0.84	1.19 – 4.77
Not employed and not looking	114	0.91	0.27	0.50 – 1.63	1.11	0.44	0.51 – 2.41
<b>Highest level of education completed</b>							
None or primary	139	1.00	-	-	1.00	-	-
Secondary+	216	1.63**	0.37	1.05 – 2.55	1.14	0.40	0.58 – 2.26
<b>Currently married/living with partner</b>							
Yes	91	1.00	-	-	1.00	-	-
No	268	3.26***	0.93	1.86 – 5.71	2.39*	0.94	1.10 – 5.19
<b>Alcohol consumption in past 30 days</b>							
None	179	1.00	-	-	1.00	-	-
1-2 days	55	4.56***	1.57	2.32 – 8.96	4.92***	1.92	2.29 – 10.57
3-5 days	59	13.40***	4.74	6.70 – 26.80	10.74***	4.31	4.89 – 23.58
6-10 days	51	17.20***	6.62	8.09 – 36.58	15.54***	7.32	6.17 – 39.12
11+ days	17	14.12***	8.09	4.59 – 43.42	11.24***	7.24	3.18 – 39.72
<b>Residence</b>							
Outside Mongu	146	1.00	-	-	1.00	-	-
Within Mongu	210	0.32***	0.08	0.20 – 0.50	0.48*	0.16	0.24 – 0.94
<b>Years residing at current residence</b>							
Less than 1 year	61	1.00	-	-	1.00	-	-
1-5 years	144	0.44**	0.15	0.22 – 0.87	0.63	0.29	0.26 – 1.55
6-10 years	56	0.68	0.19	0.40 – 1.17	0.79	0.29	0.38 – 1.62
11-15 years	9	0.58	0.20	0.29 – 1.15	0.62	0.30	0.25 – 1.58
16+ years	90	0.52	0.39	0.12 – 2.22	0.48	0.53	0.05 – 4.18

\*p<0.10 \*\*p<0.05 \*\*\*p<0.01

## Discussion

The PLACE method was used to understand the roles of age, alcohol consumption and poverty in the specific context of Zambia. In this particular setting age was not a significant factor, but alcohol use, type of venue and poverty or the desire for economic advancement were significant factors.

In the multivariate analyses, type of venue was a significant factor for women with regard to transactional sex. Those socializing at the Nightlife/Drinking sites had a higher odds of transactional

sex compared to those in the Open/Transport-related sites. A study of adolescent girls and young women in Zimbabwe also found that individuals with particularly risky sexual behaviors tended to frequent Nightlife/Drinking sites<sup>17</sup>. While community informants indicated that other types of sites are places where people meet new sexual partners, those sites are also places where people are going about their daily lives.

A key factor for women was being unemployed and looking for work which can be seen as an indicator of poverty or perhaps a desire for advancement. About 92% of women and 94% of men interviewed at the venues indicated that unemployment was a big problem in their community<sup>16</sup>. Unfortunately the variable used does not differentiate between women looking for work because of dire poverty and those women not in poverty but perhaps looking to obtain a higher social standing or obtain material goods. This is a limitation of the variable and an area that warrants future research – poverty per se versus the desire for advancement for those not necessarily experiencing poverty.

The literature suggests a dose-response relationship between alcohol use and sexual behaviors such that the heaviest and most symptomatic drinkers are at greatest risk of being HIV positive<sup>4</sup>. In this analysis the odds ratios for alcohol use were quite high and demonstrated a dose-response effect for both transaction sex and having two or more partners in the past year. Alcohol abuse was cited as a big problem by 73% of men and 69% of men socializing at the venues,<sup>16</sup> so this is an issue that the community sees as an important issue that needs to be addressed.

Being single was a risk factor for women for both transactional sex and having two or more partners in the past year. Residence outside the urban Mongu boundary and shorter-term residence were associated with greater risk. Education and age were not significant factors in the multivariate analysis. These findings indicate the need to have comprehensive multifaceted program interventions aimed at reaching individuals of all ages and educational backgrounds. Particular emphasis must be paid regarding alcohol use and risky sexual behaviors and creating more economic opportunities for women. Outreach to areas outside of urban Mongu and to those who have recently moved into the area is needed to address these higher risk groups. Placing interventions such as prevention messages and condom distribution at the venues where people meet new partners will be a step towards reaching high risk individuals.

The PLACE method provides us with information on where to target interventions at the local level. The method also helps identify particular individual factors that may be associated with risky sexual behaviors. The method has some limitations. It is as yet unknown whether targeting interventions

at venues will lead to a reduction in HIV prevalence in a community. Such evaluations will need to be done in communities that have targeted interventions in public venues based on findings from a PLACE study. It could be that community informants do not identify all public venues, this leaving out some groups that may be at high risk of HIV. Self-reported data on sexual behavior is generally subject to self-presentation bias. However there may be less bias in the PLACE study than in a household study because individuals may feel more relaxed in social environments. Despite the limitations the PLACE method helps shed light on local HIV epidemics in a quick and relatively inexpensive manner.

## Conclusion

Key factors that influenced risky sexual behavior among women in this study were alcohol use, type of venue where the respondent was interviewed, and poverty and/or the desire for economic advancement. Other significant factors were being single, residence outside of urban Mongu and short-term residence. In terms of programmatic and policy implications it is important to address the link between alcohol use and risky sexual behavior as creating more economic opportunities.

## Acknowledgements

This paper is based on work funded by the U.S. Agency for International Development (USAID) under the terms of Cooperative Agreement GPO-A-00-03-00003-00. The authors wish to thank the interviewers and respondents for their participation, efforts and time. They also wish to thank Paul Brodish for his assistance with revising the manuscript.

## References

1. UNAIDS. 2008 Report on the Global AIDS Epidemic. Geneva; 2008.
2. Macro International Inc. HIV Prevalence Estimates from the Demographic and Health Surveys. Calverton, Maryland: Macro International Inc.; 2008.
3. Fisher JC, Cook PA, Sam NE, Kapiga SH. Patterns of alcohol use, problem drinking, and HIV infection among high-risk African women. *Sexually Transmitted Diseases*. 2008 Jun;35(6):537-44.
4. Fisher JC, Bang H, Kapiga SH. The association between HIV infection and alcohol use: A systematic review and meta-analysis of African

- studies. *Sexually Transmitted Diseases*. 2007 Nov;34(11):856-63.
5. Kalichman SC, Simbayi LC, Kaufman M, Cain D, Jooste S. Alcohol use and sexual risks for HIV/AIDS in sub-Saharan Africa: Systematic review of empirical findings. *Prevention Science*. 2007 Jun;8(2):141-51.
  6. Mataure P, McFarland W, Fritz K, Kim A, Woelk G, Ray S, et al. Alcohol Use and High-Risk Sexual Behavior Among Adolescents and Young Adults in Harare, Zimbabwe. *AIDS and Behavior*. 2002;6(3):211-9.
  7. Shelton JD, Cassell MM, Adetunji J. Is poverty or wealth at the root of HIV? *Lancet*. 2005;366(9491):1057-8.
  8. Mishra V, Assche SRV, Greener R, Vaessen M, Hong R, Ghys PD, et al. HIV infection does not disproportionately affect the poorer in sub-Saharan Africa. *Aids*. 2007;21:S17-S28.
  9. Nattrass N. Poverty, Sex and HIV. *AIDS and Behavior*. 2009;13(5):833-40.
  10. Msisha WM, Kapiga SH, Earls F, Subramanian SV. Socioeconomic status and HIV seroprevalence in Tanzania: a counterintuitive relationship. *International Journal of Epidemiology*. 2008;37(6):1297-303.
  11. Central Statistical Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), University of Zambia, Macro International Inc. Zambia Demographic and Health Survey 2007. Calverton, Maryland, USA: CSO and Macro International Inc.; 2009.
  12. MEASURE Evaluation Project. Priorities for Local AIDS Control Efforts (2005) A Manual for Implementing the PLACE Method. Chapel Hill, NC: MEASURE Evaluation Project: University of North Carolina at Chapel Hill; 2005.
  13. Grassly NC, Garnett GP, Schwartlander B, Gregson S, Anderson RM. The effectiveness of HIV prevention and the epidemiological context. *Bulletin of the World Health Organization*. 2001;79(12):1121-32.
  14. Anderson R. Transmission dynamics of sexually transmitted infections. In: Holmes K, Mardh P, Sparling P, eds. *Sexually Transmitted Diseases*. New York: McGraw-Hill 1999:25-37.
  15. Central Statistical Office (CSO). HIV/AIDS Epidemiological Projections 1985-2010. Lusaka, Zambia: Government of Zambia; 2005.
  16. Frontiers Development and Research Group, MEASURE Evaluation. PLACE in Zambia: Identifying Gaps in HIV Prevention in Mongu, Western Province, 2005. Chapel Hill, NC: Carolina Population Center, University of North Carolina at Chapel Hill; 2006.
  17. Singh K, Sambisa W, Munyati S, Chandiwana B, Chingono A, Monash R, et al. Targeting HIV Interventions for Adolescent Girls and Young Women in Southern Africa: Use of the PLACE Methodology in Hwange District, Zimbabwe. *AIDS and Behavior*. 2010;14(1):200-8.