

## **Correlates of syphilis infection among men and women in Zambia: analysis of the 2001 Demographic and Health Survey data.**

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### **Background**

The purpose of this analysis was to identify correlates of syphilis sero-status among men, women and cohabiting couples in the Zambian Demographic and Health Survey (ZDHS). The 2001 ZDHS included, for the first time, collection of venous blood samples (1). These were tested for syphilis infection and linked to the anonymised results of the individual interviews. Couples living in the same household can be identified and their interview and syphilis data can be linked. The ZDHS collected information on characteristics that may affect the risk of having acquired syphilis infection including: sexual behaviour in the 12 months before the survey, marital status, the length of time respondents had lived in their present home and, from men only, travel away from home in the year before the survey. Mobility, both short term and longer term, is of particular interest because travel may involve movement from an area of low prevalence to one of higher prevalence and because people may behave in a more risky manner when they are away from home.

### **Methods**

Socio-demographic, behavioural and mobility characteristics were analysed for association with syphilis seropositivity for all men, all women and the male and the female partner in the matched couples.

In the analyses of individual men and women, syphilis prevalence among members of the opposite sex in the same sample stratum was included in the regression models to control for the fixed effects of geographical variations in the prevalence of syphilis. In the couple analyses the partner's syphilis status was included in the regression model to account for transmission between spouses. Multi-level modelling was used to identify whether the variations in syphilis status are attributable more to geographical variations in syphilis prevalence or to differences in individual risk behaviours.

All analyses were carried out in Stata Special Edition version 8.2 (2). The stratification and clustering in the survey sample was taken into account in the calculation of standard errors and the data were weighted to provide nationally representative results. Polygamous men were matched to all co-resident wives but this analysis included only the man and his first ranked wife. The analysis was also restricted to couples where both partners had been tested for syphilis.

### **Results**

Interview data and syphilis status was available for 72% of eligible men (1745) and 78% of eligible women. Of the eligible men in the selected households 73% were successfully tested for syphilis and 90% were successfully interviewed. Most of this difference is accounted for by refusal of syphilis testing. The same pattern is seen for eligible women, 78% of whom were successfully tested for syphilis and 97% successfully interviewed.

The prevalence of syphilis infection among those tested and interviewed was 7.2% for men and 6.5% for women. Prevalence varied by region with infection commonest in residents of Lusaka and the Eastern and Copperbelt provinces. Sero-prevalence was higher among married and cohabiting couples and discordancy was common: in 4.1% of couples both partners were infected, in 3.9% only the man was infected and in 3.6% only the woman.

Eight percent of men and 12% of women had moved to their current home within the year prior to the survey, whilst a third of the men and a quarter of the women had always lived in that place. A third of men had made two or more trips away from home in the last year, and 17% had been away for one month or more.

In the year before the survey 81% of men and 75% of women had had sex. In the last year, 35% of men had sex with a non-cohabiting partner and 10% of men reported having sex with someone they had paid. A fifth of men reported having sex with more than one person in the year before the survey. Fewer women reported sex outside marriage, 14% had had sex with a non-cohabiting partner and only 3% of women reported having sex with more than one person in the year before the survey. Two percent of women and 13% of men reported having sex with a person they had known for less than one month at some point in the year before the survey.

Nine percent of the matched couples were polygamous. Five percent of men and 9% of women moved to their current residence within the last year. Most of the men had been away from home in the last year, 40% had made two or more trips and 15% had been away for a month or more. In the year before the survey 20% of men had sex with a partner they did not live with and 22% had sex with more than one person. Only 6% of these men reported sex with a CSW in the last year. In contrast fewer than 2% of women reported either extra-marital sex, or multiple partners within the year before the survey. In the last year 7% of male partners and 0.5% of female partners had sex with a partner they had known for less than one month.

### **Associations with syphilis infection**

#### *Men*

Table 1 shows the crude odds ratios for the association of syphilis infection by socio-demographic, sexual behaviour and mobility characteristics. Older men and those in commercial agriculture, manual labour and service occupations (compared to those not working) have increased odds of syphilis. Never married men are

much less likely to have syphilis than currently married men. Divorced men are much more likely to be infected than married men but separated or widowed men do not share this excess risk. Men who had moved to their current home within the last year were twice as likely as others to be infected. An early age at first sex, sex with multiple partners in the last year, with non-cohabiting partners in the last year and with commercial sex workers all increased the odds of infection.

In the adjusted model (Table 1) the associations with marriage remain unchanged. Men reporting more than one partner in the last year had more than twice the odds of syphilis compared to other men. Adjusted for other variables the higher odds of syphilis infection among mobile men and those reporting commercial sex remained but were of borderline significance. Syphilis prevalence among women in the stratum is strongly associated with male syphilis status but regional differences persist when this is controlled for.

#### Women

Table 1 shows the crude and adjusted OR for women's syphilis status. Never married women had lower odds of infection compared to ever married women. Sex with a partner known for less than one month showed a strong positive association with syphilis. There were also marked regional differences in syphilis status. These associations all remained in the adjusted model which included the prevalence among men in the same stratum.

**Table 1: Associations with syphilis infection for men and women**

OR for syphilis	Men		Women	
	Crude	Adjusted	Crude	Adjusted
Aged 15-24	<b>0.29**</b>		0.72	
Not working (reference)	1		1	
Commercial agriculture	<b>2.82*</b>		1.45	
Subsistence agriculture	1.55		1.13	
Manual	<b>2.81**</b>		1.99	
Service	<b>2.53*</b>		<b>1.96*</b>	
Professional	0.8		0.91	
Never married	<b>0.23**</b>	<b>0.23**</b>	<b>0.41**</b>	1
Currently married (reference)	1	1	1	
Widowed/separated	1.13		0.8	} <b>2.92**</b>
Divorced	<b>6.73**</b>	<b>6.3**</b>	1.75	
Lived in home less than one year	2.05	1.95	1.22	
Always lived in this place	<b>0.6*</b>		0.97	
Sex by 15	<b>1.97**</b>		1.51	
Had sex with >1 partner in last year	<b>2.82**</b>	<b>2.19**</b>	2.14	
UN1 Higher risk sex	<b>1.69*</b>		1.14	
UN3 Commercial sex	<b>2.79**</b>	1.98		
Sex with non-cohabiting partner in last year	<b>2.17**</b>		1.39	
Sex with partner known <1 month in last year			<b>3.05*</b>	<b>3.86**</b>
Central	<b>0.26**</b>	0.65	<b>0.43*</b>	1.68
Copperbelt	1.52	2.62	<b>1.63*</b>	<b>4.32**</b>
Eastern	<b>1.91**</b>	<b>3.48**</b>	1.25	<b>2.81*</b>
Luapula	0.94	1.7	1.18	<b>3.39*</b>
Lusaka	<b>1.9*</b>	<b>2.91*</b>	1.44	<b>3.28*</b>
Northern	<b>0.3**</b>	1	<b>0.26*</b>	1
North-Western	0.68	1.31	1.08	<b>3.23*</b>
Southern	0.63	1.19	0.46	1.56
Western	0.83	1.11	1.44	<b>4.11**</b>
Prevalence among opposite sex in same stratum		<b>63.5**</b>		<b>37.2**</b>

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

#### Couples

Table 2 gives the crude and adjusted OR for syphilis in the male partner by various characteristics of the male and female partners. Woman's syphilis status and men's sexual behaviour were the factors significantly associated with infection. Having moved to their current residence in the last year was of borderline significance.

In the adjusted model controlling for the syphilis status of the female partner, the man's extra-marital sexual behaviour was still associated with increased odds of being sero-positive and men married to women who had always lived in their current home had a lower chance.

Table 3 gives the crude OR for syphilis in the female partner by various characteristics of the woman and her husband. Syphilis in the female partner was associated with living in urban areas, having moved in the last year and having had sex with a new partner in the last year. The length of time the husband had lived in the home was also important. Table 3 also gives the adjusted results for two multiple regression models. In both models there are significant regional effects, and the syphilis status of the male partner is very important. In model 1 the odds of infection are higher if either the man or the women had moved house in the last year, but there was no additional effect if both had moved. In model 2 the sexual behaviour of the female partner (sex with a new partner in the last year) is important and including this in the model removes the effect of a recent move by the male partner.

**Table 2: Crude and adjusted odds ratios for syphilis infection in the male partner by characteristics of the male and female partners (854 couples)**

Man's Characteristics	Crude		Adjusted	
	OR	p-value	OR	p-value
Lived in home less than one year	2.58	0.0523		
Had sex with more than one person in last year	2.53	0.0019		
Had sex with a non-cohabiting partner in last year	2.64	0.0011	3.01	<b>0.002</b>
<b>Wife's characteristics</b>				
Always lived in current home	0.34	0.0142	0.24	<b>0.005</b>
Wife has syphilis	25.17	<0.0001	28.25	<b>&lt;0.001</b>
<i>Region:</i>				
Central	0.76	0.686	0.3	0.111
Copperbelt	3.59	0.015	1.41	0.552
Eastern	3.62	0.006	2.12	0.109
Luapula	1.3	0.688	0.39	0.215
Lusaka	2.85	0.047	0.89	0.852
North-Western	2.31	0.173	0.87	0.866
Southern	1.23	0.752	0.79	0.729
Western	1.8	0.339	0.53	0.378

**Table 3: Crude and adjusted odds ratios for syphilis infection in the female partner by characteristics of the male and female partners (746 couples).**

Woman's characteristics	Crude		Model 1		Model 2	
	OR	p-value	OR	p-value	OR	p-value
Lived in home less than one year	3.32	0.0018	3.67	<b>0.007</b>	4.28	<b>0.002</b>
Had sex with partner known <1month	14.6	0.0081			54.5	<b>&lt;0.001</b>
<b>Husband's characteristics</b>						
Lived in home less than one year	4.5	0.0006	3.27	<b>0.032</b>		
Always lived in current home	0.47	0.0276				
Husband has syphilis	25.17	0.0000	27.7	<b>&lt;0.001</b>	27.01	<b>&lt;0.001</b>
<b>Couple's characteristics</b>						
Rural residents	0.48	0.0094				
<i>Region:</i>						
Northern	1		1		1	
Central	3.99	0.090	7.57	0.074	7.18	0.064
Copperbelt	12.25	0.001	12.48	<b>0.017</b>	14	<b>0.009</b>
Eastern	7.08	0.012	6.41	0.078	6.46	0.061
Luapula	9.40	0.004	16.17	<b>0.008</b>	15.44	<b>0.006</b>
Lusaka	10.02	0.004	11.6	<b>0.024</b>	10.59	<b>0.021</b>
North-Western	7.11	0.014	10.13	<b>0.042</b>	9.29	<b>0.039</b>
Western	0.73	0.796	7.77	0.059	5.56	0.087

## Discussion

The analysis revealed significant correlates of syphilis sero-status. Marriage is associated with syphilis infection, in agreement with the results of a previous study in Zambia (3). Some sexual behaviours are also associated: men who had more than one partner in the last year and women who had had sex with a partner known for less than one month were more likely to be sero-positive. These associations remained after adjusting for local area syphilis prevalence, which suggests that individual behaviour is correlated with syphilis sero-status independently of the background syphilis prevalence. This is supported by the results from the couple analysis which show that, even controlling for the status of the sexual partner, the respondents own behaviour is still correlated with syphilis sero-status. This is true for men and women and, together with the equal split of male and female infected partners in discordant couples, suggests that both partners may acquire infection outside the marriage. However, it is not possible to determine this from these cross-sectional data. Positive sero-status does not indicate active disease, and the timing of any treatment that may have affected syphilis cannot be established. The observed pattern of discordance in couples may be the result of differences in treatment seeking behaviours.

The only mobility measure to show an association with syphilis infection was the duration of residence in the current home. A recent move was associated with an increased risk of syphilis infection and having always lived in the same home was associated with lower odds of infection. This may be partially explained by marriage, since this seems to be a risk in itself and moving house may be connected with getting married.

The other mobility measures may not have shown an association with syphilis because they described a history of travel but did not describe where travellers had visited, which may be the most important component of this risk. The DHS may only have captured relatively low-risk travellers because more mobile individuals might have been absent from home. This is likely to affect the syphilis test data to the greatest extent because these data were only collected on one occasion whereas three attempts were made to interview eligible respondents. The most mobile individuals may be under-represented in the couple sub-sample but should have been identified in the samples of all men and women, though they may not have been interviewed in their own home. There were no associations between mobility and whether respondents were tested successfully. Therefore any failure to interview or test the more mobile individuals is unlikely to have undermined these results.

Significant geographical variations in syphilis prevalence present an obstacle for straightforward analysis. Some of the variation in syphilis sero-status should be explained by differences in individual behaviour and some by the background prevalence in the places from which sexual partners are selected. To some extent this has been controlled for by including small area prevalence estimates in the regression models. Multi-level modelling should make it possible to compare the relative importance of variations in individual behaviour and prevalence among potential sexual partners.

## Conclusion

It is possible to identify both sexual behaviour and mobility characteristics which correlate with syphilis sero-status among this sample of the general population in Zambia. However the mobility data is limited in this respect because the results are not actionable. More detailed information on destinations would be necessary to inform any interventions. The geographical differences in prevalence, and their relative importance as a determinant of infection status, in comparison with risky behaviour, warrant further investigation. This would elucidate whether the risky sexual behaviours are a greater or lesser determinant of an individual's syphilis status in the regions of Zambia where syphilis is very common.

## References

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