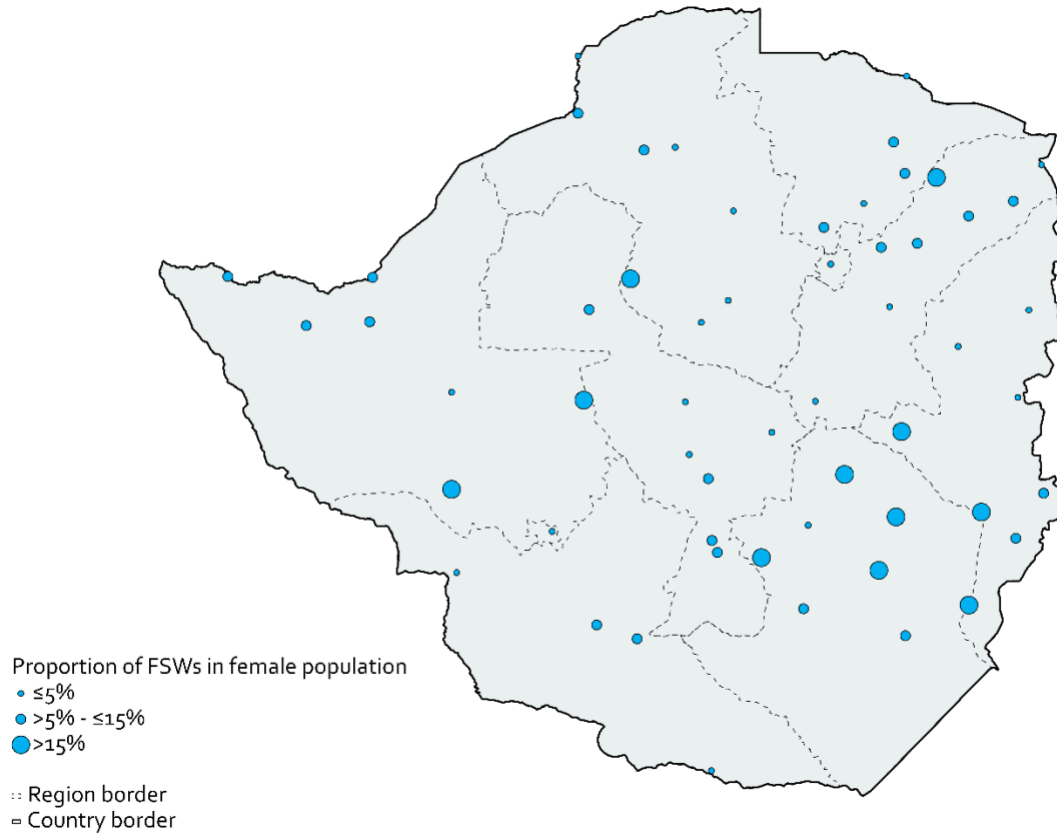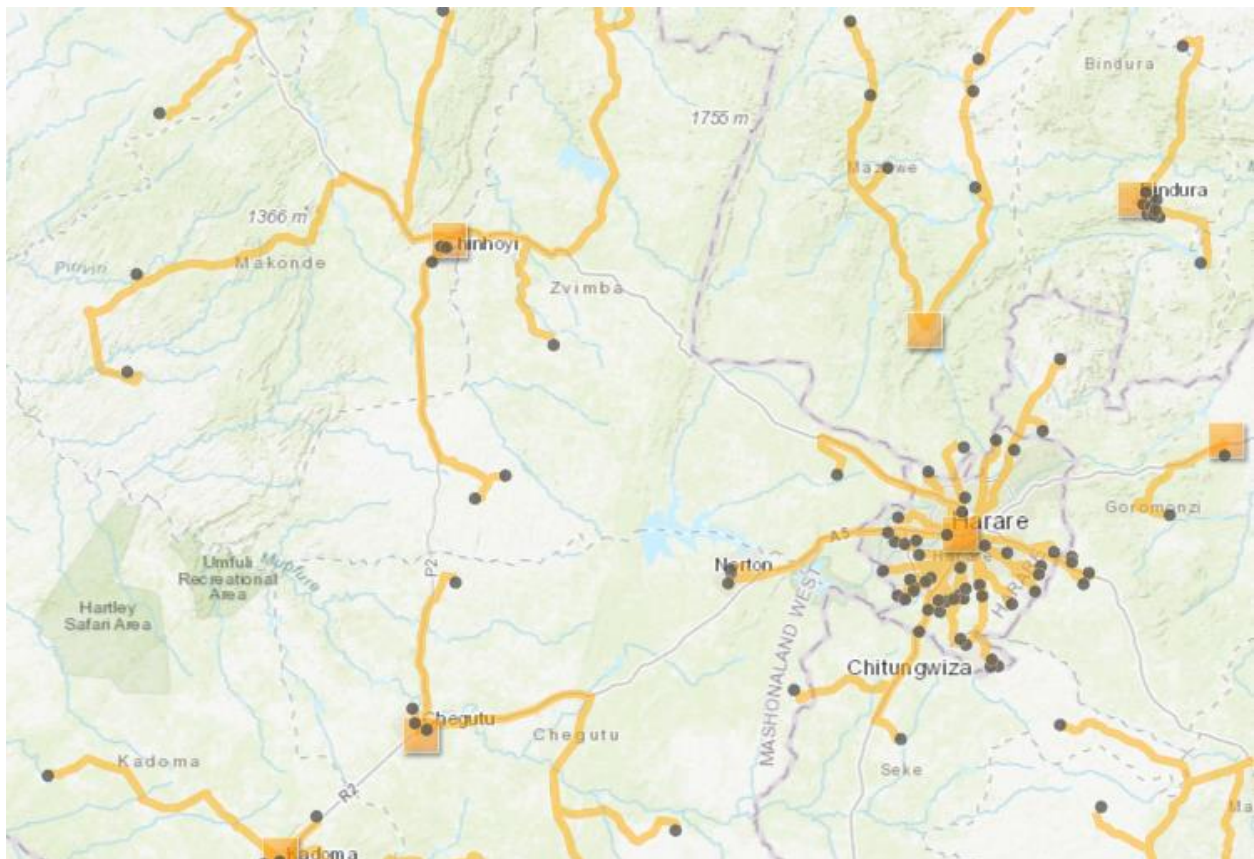**Supplementary information**

Supplementary Figure 1. Percentage of female sex workers (FSWs) as proportion of the female population per sex work site in Zimbabwe. FSW size estimates come from the CeSHHAR database [12], female population density data are based on population estimates provided by the WorldPop project (https://www.worldpop.org/). Each blue circle represents a sex work site, the size indicated the proportion of FSWs in the underlying female population.
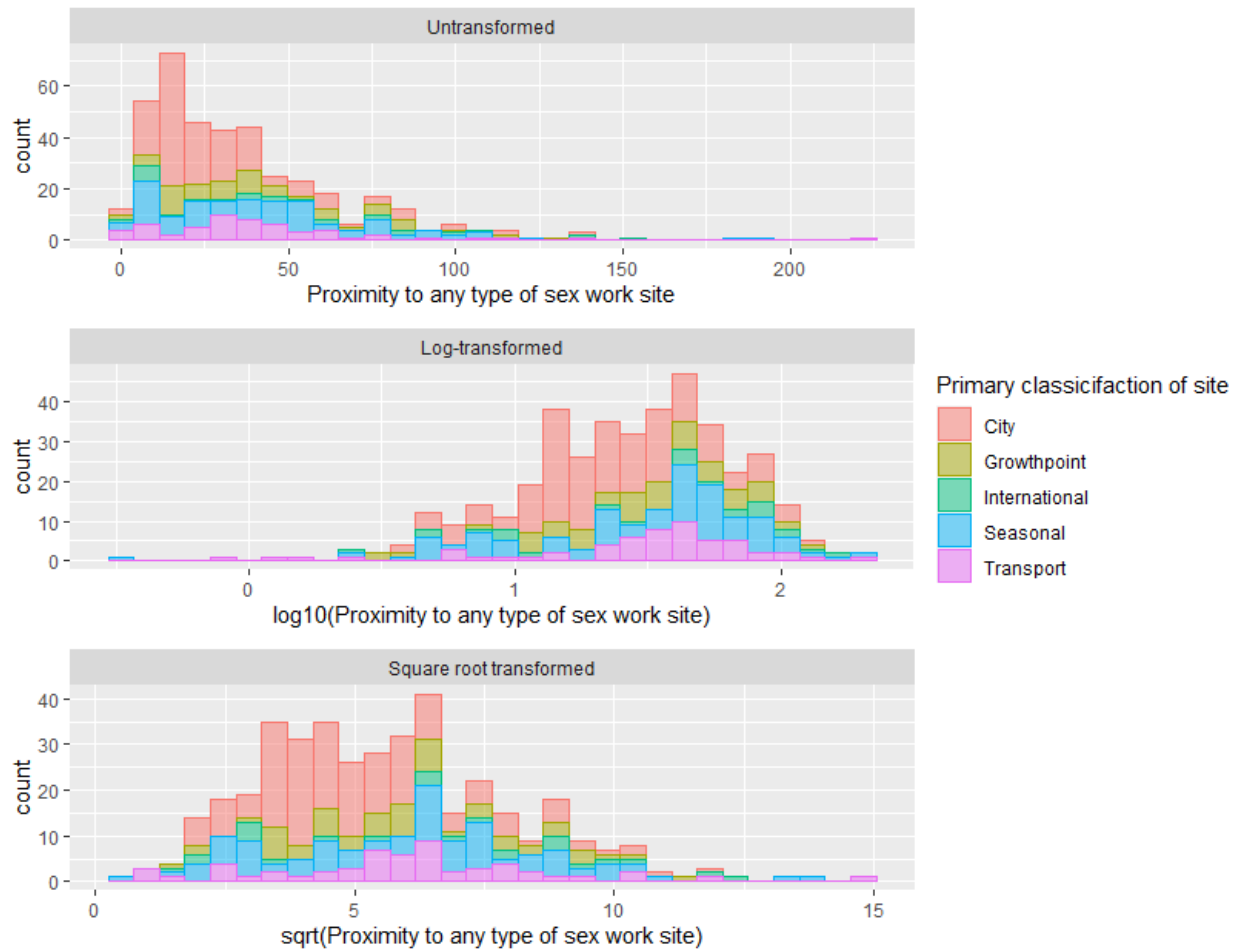
Supplementary Figure 2. Example of the calculation of distance and time from the Zimbabwe 2015 DHS sample location to the nearest sex work site over road. DHS sample locations are represented by black dots and sex work locations by orange squares. Each orange line represents a distance calculation from a DHS sample location to the nearest sex work site by road.

Supplementary Figure 3. Association between proximity to the nearest sex work site and HIV prevalence among the general population (by the DHS sample location in Zimbabwe in 2015), explored as continuous (pan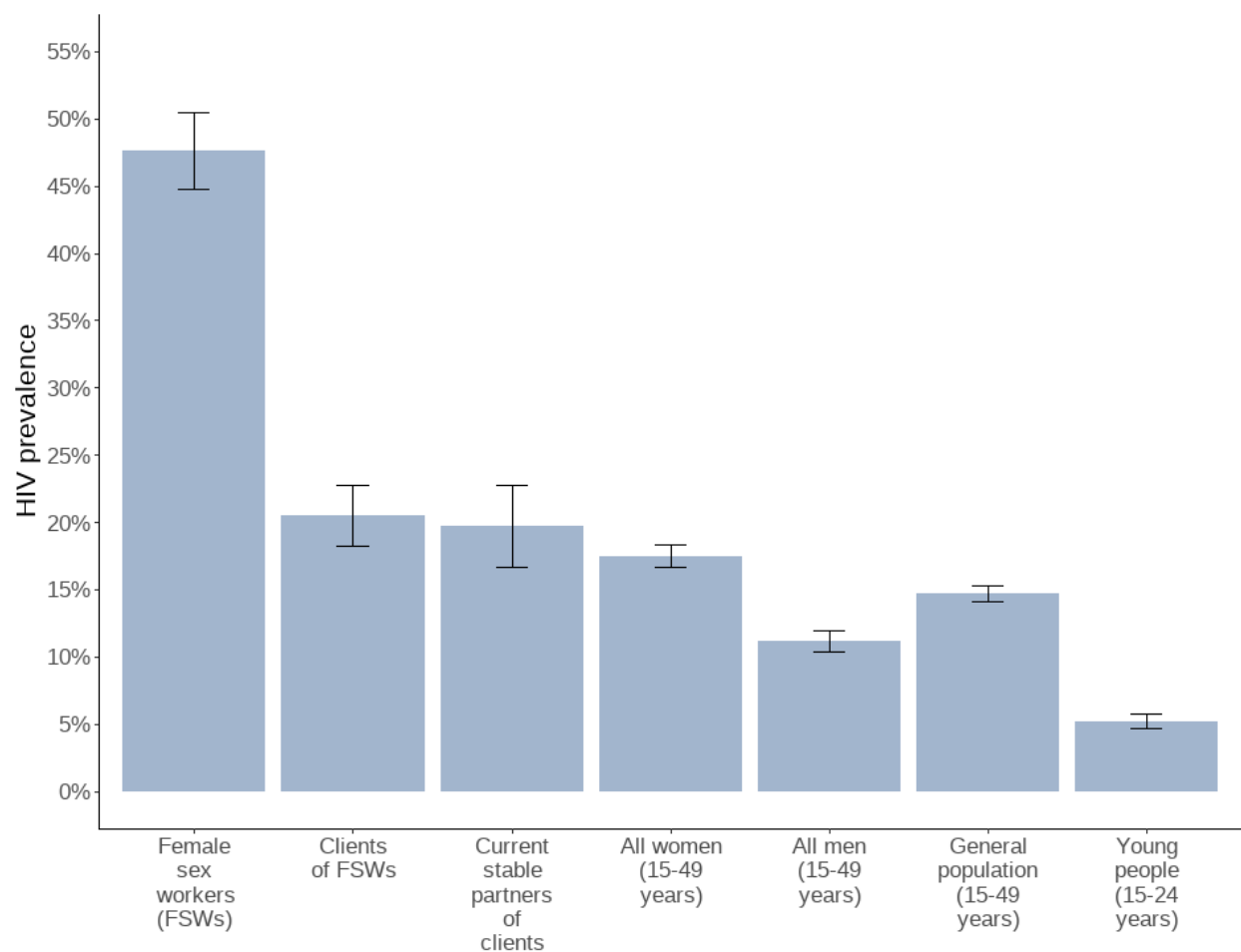el A), logarithmic (panel B), and square root (panel C). The colors represent the primary classification of the sex work site.
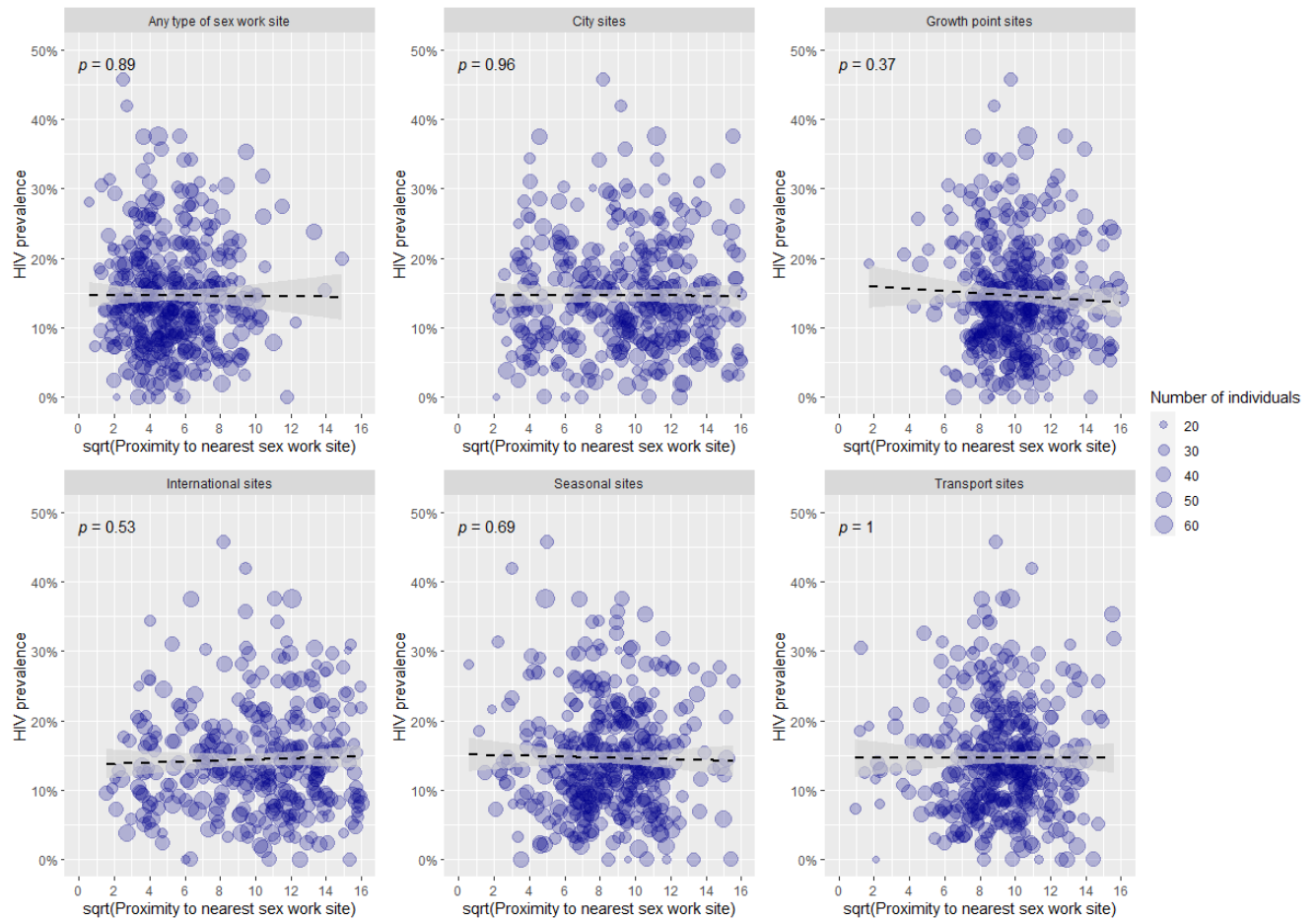
Supplementary Table 1. Characteristics of the DHS data, Zimbabwe, 2015. Data obtained through https://dhsprogram.com/.

Characteristics	N; %	HIV prevalence
	All individuals *N=16,121*	*All HIV-positive individuals* *N=2,373 HIV+ (14.7%)*
Sex		
Male	7,069 (43.8%)	11.2% (791 HIV+)
Female	9,052 (56.2%)	17.5% (1,582 HIV+)
Age		
mean [SD]	*27.2 [9.3]*	*34.2 [8.3]*
15-24 years	6,739 (41.8%)	5.1% (349 HIV+)
25-34 years	4,922 (30.6%)	16.7% (822 HIV+)
35+ years	4,460 (27.7%)	27.0% (1,202 HIV+)
Place of residence		
De Jure (*i.e.,* usual resident)	15,448 (95.8%)	14.5% (2,284 HIV+)
De Facto (*i.e.,* slept at residence last night)	16,121 (100%)	14.7% (2,373 HIV+)
HIV status		
Positive	2,373 (14.7%)	N/A
Negative	13,748 (85.3%)	N/A
Sex work client, ever (males only)		
Yes	1,529 (21.6%)	20.5% (313 HIV+)
No	5,540 (78.4%)	8.6% (478 HIV+)
Sex work client, in the last year (males only)		
Yes	822 (11.6%)	19.7% (162 HIV+)
No	6,247 (88.4%)	10.1% (629 HIV+)
Current partner of sex work client (females only)		
Yes	787 (4.9%)	19.7% (155 HIV+)
No	8,265 (95.1%)	17.3% (1,427 HIV+)
Lifetime number of sex partners		
mean [SD]	*2.7 [6.4]*	*4.6 [9.3]*
None	3,309 (20.5%)	3.4% (106 HIV+)
1-3	9,651 (59.9%)	16.0% (1,543 HIV+)
4-9	2,251 (14.0%)	22.8% (513 HIV+)
9+	910 (5.6%)	23.2% (211 HIV+)
Condom used last sex		
Yes	2,926 (18.2%)	29.9% (875 HIV+)
No	13,195 (81.8%)	11.4% (1,498 HIV+)
Circumcised (males only)		
Yes	1,150 (16.3%)	7.4% (85 HIV+)
No	5,916 (83.7%)	11.9% (706 HIV+)
Type of place of residence		
Urban	6,737 (41.8%)	19.9% (1,340 HIV+)
Rural	9,384 (58.2%)	11.0% (1,033 HIV+)
Human mobility in the last year		
Low	8,505 (52.8%)	14.5% (1,231 HIV+)
High	7,616 (47.2%)	15.0% (1,142 HIV+)

Supplementary Figure 4. HIV prevalence in Zimbabwe among different subpopulation groups. Female sex workers data are obtained from CeSHHAR data, Zimbabwe, July 2018 – June 2020. Other subpopulation data are obtained from the DHS 2015 through https://dhsprogram.com/. HIV prevalence is highest among FSWs (47.6% [44.7%-50.4%]), followed by FSW clients (20.5% [18.2%-22.8%]) and current stable partners of FSW clients (19.7% [16.7%-22.7%]). HIV prevalence among the general population is 14.7% [14.1%-15.3%], among all women 17.7% [16.7%-18.4%], among all men 11.2% [10.4%-12.0%], and among young people (15-24 years) 5.2% [4.7%-5.7%].

Supplementary Figure 5. Association between proximity to the nearest sex work site and HIV prevalence among the general population (by DHS sample location) for any type (or classification) of sex work site and for all types separately. Sizes of the in total 400 bubbles represent the number of individuals in each DHS sample location. Dashed lines represent generalized linear regression lines. The p-values are given for the association between the HIV prevalence among the general population and square root transformed proximity to the nearest sex work site for each plot. For none of the types of sex work sites the slope was significantly differed from zero.

Supplementary Table 2. Multivariate multilevel logistic regression analysis of HIV status among Zimbabwean males and females age 15-49 – stratified by urban versus rural classification of DHS sample locations. The models are adjusted for DHS sample location random effects.

Covariate	Urban, multivariate analysis			Rural, multivariate analysis		
	aOR [95% CI]	p-value		aOR [95% CI]	p-value	
Proximity to the nearest female sex work site (km, square root transformed)						
All sites	-			-		
Proximity to the nearest female sex work site (km, square root transformed) by type						
City	1.015 [0.991–1.040]	0.223		0.993 [0.971–1.016]	0.536	
Economic growth point	0.953 [0.925–0.981]	0.001	**	1.016 [0.991–1.042]	0.251	
International	0.994 [0.972–1.016]	0.601		1.002 [0.982–1.022]	0.336	
Seasonal	0.984 [0.958–1.010]	0.231		0.993 [0.970–1.016]	0.555	
Transport	1.002 [0.974–1.031]	0.892		1.013 [0.987–1.040]	0.321	
Percentage of FSW clients as proportion of all men in survey at sample location						
<5%	-			-		
5%-15%	-			-		
≥15%	-			-		
Percentage of FSWs as proportion of the female population in 50 km radius around sample location						
<5%	-			-		
5%-15%	-			-		
≥15%	-			-		
Sex						
Male	1			1		
Female	2.656 [2.157–3.270]	<0.001	***	2.236 [1.902–2.628]	<0.001	***
Age						
15-24 years	1			1		
25-34 years	2.400 [1.905–3.025]	<0.001	***	2.760 [2.262–3.369]	<0.001	***
34+ years	4.670 [3.709–5.879]	<0.001	***	5.325 [4.389–6.461]	<0.001	***
Sex work client ever (males only)						
Yes	1.489 [1.137–1.949]	0.004	**	-		
No	1			-		
Sex work client in the last year (males only)						
Yes	-			-		
No	-			-		
Partner of FSW client (females only)						
Yes	-			-		
No	-			-		

Lifetime number of sex partners						
None	0.477 [0.339–0.670]	<0.001	***	0.532 [0.390–0.725]	<0.001	***
1-3	1			1		
4-9	2.061 [1.669–2.545]	<0.001	***	2.143 [1.777–2.583]	<0.001	***
9+	2.498 [1.860–3.355]	<0.001	***	2.075 [1.566–2.751]	<0.001	***
Circumcised (males only)						
Yes	0.672 [0.476–0.948]	0.024	*	0.701 [0.479–1.026]	0.068	**
No	1			1		
Sample location-level human mobility prevalence						
Low[1]	-			-		
High[2]	-			-		

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

[1] DHS sample locations with a prevalence of people with a high human mobility score of less than 50%.

[2] DHS sample locations with a prevalence of people with a high human mobility score of 50% or more.

Supplementary Table 3. Multivariate multilevel logistic regression analysis of HIV status among Zimbabwean males and females age 15-49 – stratified by level of mobility at the sample locations-level. The models are adjusted for DHS sample location random effects.

Covariate	Low mobility[1], multivariate analysis		High mobility[2], multivariate analysis		
	aOR [95% CI]	p-value	aOR [95% CI]	p-value	
Proximity to the nearest female sex work site (km, square root transformed)					
All sites	-		-		
Proximity to the nearest female sex work site (km, square root transformed) by type					
City	1.002 [0.977–1.027]	0.264	1.015 [0.990–1.041]	0.244	
Economic growth point	0.981 [0.954–1.008]	0.163	0.978 [0.948–1.008]	0.154	
International	0.997 [0.975–1.019]	0.774	0.992 [0.970–1.015]	0.485	
Seasonal	0.986 [0.961–1.011]	0.264	0.991 [0.963–1.019]	0.525	
Transport	1.009 [0.980–1.038]	0.555	1.002 [0.974–1.031]	0.889	
Percentage of FSW clients as proportion of all men in survey at sample location					
<5%	-		-		
5%-15%	-		-		
≥15%	-		-		
Percentage of FSWs as proportion of the female population in 50 km radius around sample location					
<5%	1		-		
5%-15%	1.274 [1.024–1.587]	0.030	-		*
≥15%	1.151 [0.827–1.602]	0.405	-		
Sex					
Male	1		1		
Female	2.678 [2.228–3.220]	<0.001	2.235 [1.834–2.723]	<0.001	***
Age					
15-24 years	1		1		
25-34 years	2.547 [2.072–3.131]	<0.001	2.559 [1.977–3.313]	<0.001	***
34+ years	5.467 [4.464–6.695]	<0.001	4.663 [3.620–6.007]	<0.001	***
Sex work client ever (males only)					
Yes	1.561 [1.218–2.000]	<0.001	-		***
No	1		-		
Sex work client in the last year (males only)					
Yes	-		-		
No	-		-		
Partner of FSW client (females only)					

Note: In the "Sex" and "Age" rows the *** significance markers align with the Low mobility column (2.678, 2.547, 5.467) and the High mobility column (2.235, 2.559, 4.663); the single * marker for 5%-15% and *** markers are as positioned in the table.

	OR [95% CI][1]	p		OR [95% CI][2]	p	
Yes	-			-		
No	-			-		
Lifetime number of sex partners						
None	0.533 [0.391–0.726]	<0.001	***	0.537 [0.368–0.783]	0.001	**
1-3	1			1		
4-9	1.834 [1.506–2.233]	<0.001	***	2.282 [1.808–2.880]	<0.001	***
9+	2.180 [1.635–2.907]	<0.001	***	2.241 [1.635–3.073]	<0.001	***
Circumcised (males only)						
Yes	0.603 [0.42–0.865]	0.006	**	-		
No	-			-		
Type of place of residence						
Urban	-			-		
Rural	-			-		

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

[1] DHS sample locations with a prevalence of people with a high human mobility score of less than 50%.

[2] DHS sample locations with a prevalence of people with a high human mobility score of 50% or more.