

Supplementary tables and figures for “Spatio-temporal estimates of HIV risk group proportions for adolescent girls and young women across 13 priority countries in sub-Saharan Africa”

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## The Global AIDS Strategy

Prioritisation strata	Criterion
Low	0.3-1.0% incidence and low-risk behaviour, or <0.3% incidence and high-risk behaviour
Moderate	1.0-3.0% incidence and low-risk behaviour, or 0.3-1.0% incidence and high-risk behaviour
High	1.0-3.0% incidence and high-risk behaviour
Very high	>3.0% incidence

Table B.1: Prioritisation strata according to HIV incidence in the general population and behavioural risk.

Intervention	Low	Moderate	High	Very High
Condoms and lube for those with non-regular partners(s) with unknown STI status and not on PrEP	50%	70%	95%	95%
STI screening and treatment	10%	10%	80%	80%
Access to PEP	-	-	50%	90%
PrEP use	-	5%	50%	50%
Economic empowerment	-	-	20%	20%

Table B.2: Commitments to be met for each intervention in terms of proportion of the prioritisation strata reached, where "-" represents no commitment.

## Household survey data

### Included surveys

Type	Year	Transactional sex question	Sample size			
			15-19	20-24	25-29	Total
<b>Botswana</b>						
BAIS	2013	✓	557	588	649	1794
Total			557	588	649	1794
<b>Cameroon</b>						
DHS	2004	✗	2675	2207	1732	6614
DHS	2011	✗	3588	3115	2655	9358
PHIA	2017	✗	2620	2339	2259	7218
DHS	2018	✓	3349	2463	2345	8157
Total			12232	10124	8991	31347
<b>Kenya</b>						
DHS	2003	✗	1819	1709	1391	4919
DHS	2008	✗	1767	1743	1419	4929
DHS	2014	✗	2861	2534	2858	8253
Total			6447	5986	5668	18101
<b>Lesotho</b>						
DHS	2004	✗	1761	1455	1026	4242
DHS	2009	✗	1833	1543	1194	4570
DHS	2014	✗	1537	1292	1067	3896
PHIA	2017	✓	1156	1202	1054	3412
Total			6287	5492	4341	16120
<b>Mozambique</b>						
AIS	2009	✗	1031	1106	987	3124
DHS	2011	✗	2932	2299	2206	7437
AIS	2015	✗	1552	1389	1080	4021
Total			5515	4794	4273	14582
<b>Malawi</b>						
DHS	2000	✗	2914	2998	2358	8270
DHS	2004	✗	2407	2823	2135	7365
DHS	2010	✗	5031	4387	4309	13727
DHS	2015	✓	5273	5094	3976	14343
PHIA	2016	✓	1646	1934	1511	5091
Total			17271	17236	14289	48796
<b>Namibia</b>						
DHS	2000	✗	1427	1313	1098	3838
DHS	2006	✗	2203	1869	1544	5616
DHS	2013	✗	1852	1709	1481	5042
PHIA	2017	✓	1491	1525	1370	4386
Total			6973	6416	5493	18882
<b>Eswatini</b>						
DHS	2006	✗	1265	1027	731	3023
PHIA	2017	✗	1031	895	811	2737

	Total		2296	1922	1542	5760
<b>Tanzania</b>						
AIS	2003	✗	1466	1377	1270	4113
AIS	2007	✗	2137	1676	1509	5322
DHS	2010	✗	2221	1860	1613	5694
AIS	2012	✗	2474	1923	1815	6212
PHIA	2016	✓	2999	2845	2521	8365
Total			11297	9681	8728	29706
<b>Uganda</b>						
DHS	2000	✗	1687	1541	1326	4554
DHS	2006	✗	1948	1660	1404	5012
AIS	2011	✗	2451	2164	1921	6536
DHS	2011	✗	2025	1664	1614	5303
DHS	2016	✓	4276	3782	3014	11072
PHIA	2016	✗	3289	3059	2574	8922
Total			15676	13870	11853	41399
<b>South Africa</b>						
DHS	2016	✓	1505	1408	1397	4310
Total			1505	1408	1397	4310
<b>Zambia</b>						
DHS	2007	✗	1598	1405	1373	4376
DHS	2013	✗	3685	3036	2789	9510
PHIA	2016	✓	2120	2045	1619	5784
DHS	2018	✓	3112	2687	2166	7965
Total			10515	9173	7947	27635
<b>Zimbabwe</b>						
DHS	1999	✗	1467	1230	1011	3708
DHS	2005	✗	2128	1943	1438	5509
DHS	2010	✗	1963	1796	1679	5438
DHS	2015	✓	2154	1777	1646	5577
PHIA	2016	✓	2114	1817	1573	5504
Total			9826	8563	7347	25736
Total			106397	95253	82518	284168

Table B.3: All of the surveys that we used in our analysis and their sample sizes, disaggregated by respondent age.

Survey	Exclusion reason
MOZ2003DHS	No GPS coordinates available to place survey clusters within districts.
TZA2015DHS	Insufficient sexual behaviour questions.
UGA2004AIS	Unable to download region boundaries.
ZMB2002DHS	No GPS coordinates available to place survey clusters within districts.

Table B.4: All of the surveys that were excluded from our analysis.

## Spatial analysis levels

Country	Number of areas	Analysis level
Botswana	27	3
Cameroon	58	2
Kenya	47	2
Lesotho	10	1
Mozambique	161	3
Malawi	33	5
Namibia	38	2
Eswatini	4	1
Tanzania	195	4
Uganda	136	3
South Africa	52	2
Zambia	116	2
Zimbabwe	63	2

Table B.5: The number of areas and analysis levels for each country that were used in our analysis.

## Survey questions and risk group allocation

Variable(s)	Description
v501	Current marital status of the respondent.
v529	Computed time since last sexual intercourse.
v531	Age at first sexual intercourse-imputed.
v766b	Number of sexual partners during the last 12 months (including husband).
v767[a, b, c]	Relationship with last three sexual partners. Options are: spouse, boyfriend not living with respondent, other friend, casual acquaintance, relative, commercial sex worker, live-in partner, other.
v791a	Had sex in return for gifts, cash or anything else in the past 12 months. Asked only to women 15-24 who are not in a union.

Table B.6: AIS, BAIS and DHS survey questions.

Variable(s)	Description
part12monum	Number of sexual partners during the last 12 months (including husband).
part12modkr	Reason for leaving part12monum blank.
partlivew[1, 2, 3]	Does the person you had sex with live in this household?
partrelation[1, 2, 3]	Relationship with last three sexual partners. Options are: husband, live-in partner, partner (not living with), ex-spouse/partner, friend/acquaintance, sex worker, sex worker client, stranger, other, don't know, refused.
sellsx12mo	Had sex for money and/or gifts in the last 12 months.
buysx12mo	Paid money or given gifts for sex in the last 12 months.

Table B.7: PHIA survey questions.

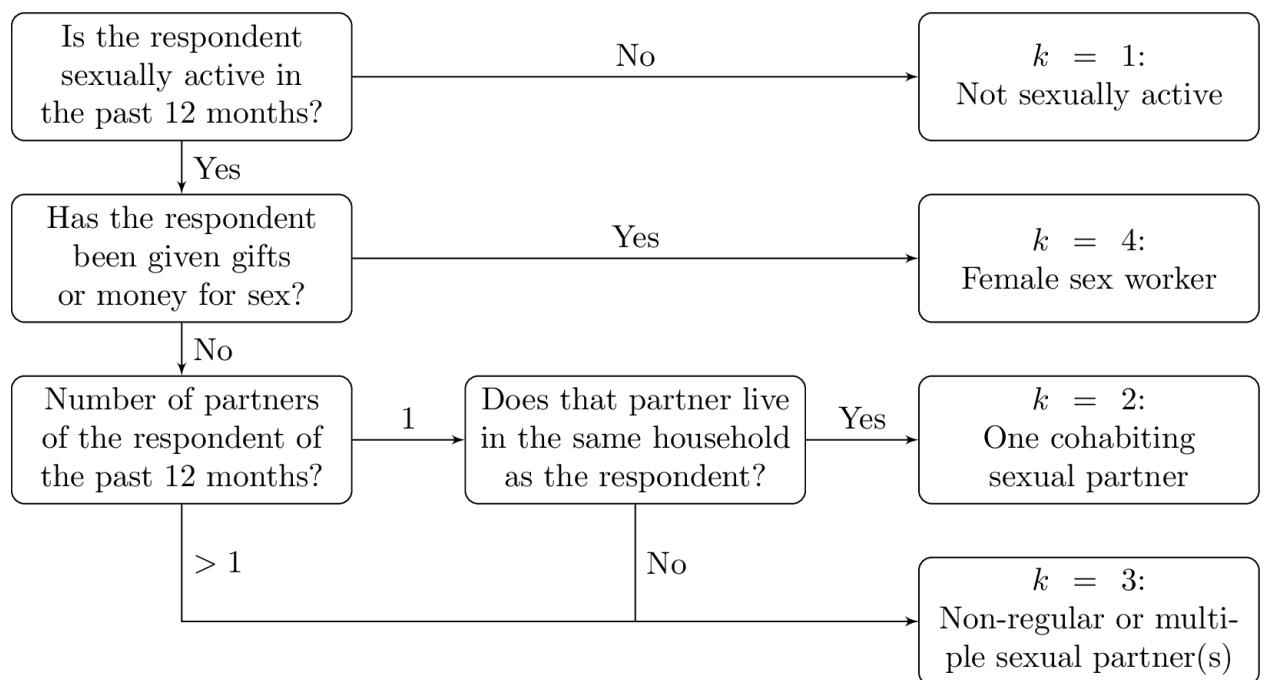


Figure B.1: Flowchart describing allocation of respondents to risk groups.

## Miscellaneous figures

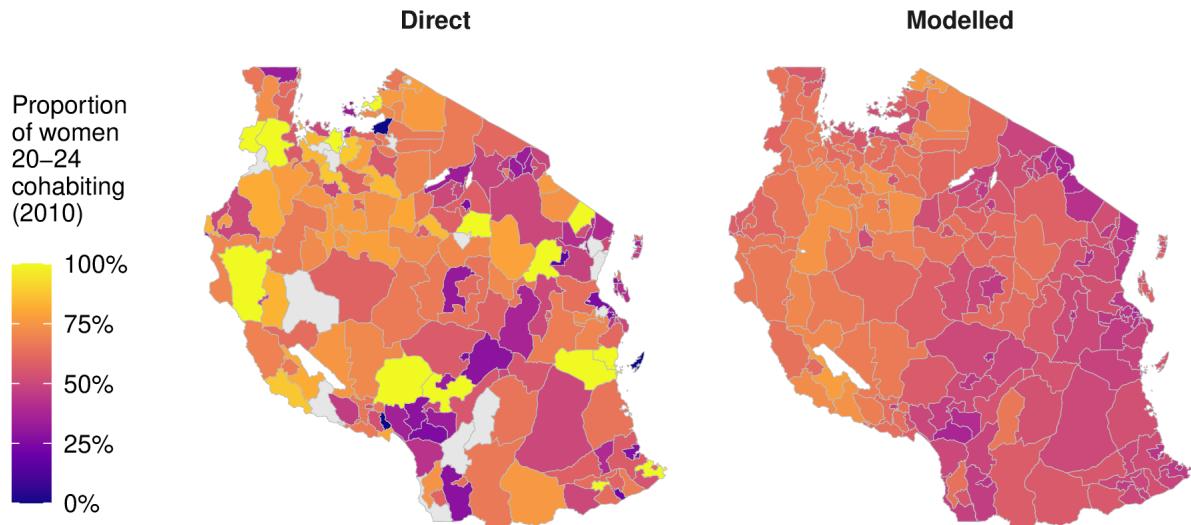


Figure B.2: Illustration our model results for AGYW 20-24 in Tanzania in 2010 in the cohabiting risk group. Compared to the direct survey results, our spatio-temporally smoothed estimates more plausibly represent district-level heterogeneity, as well as imputing any districts with missing data.

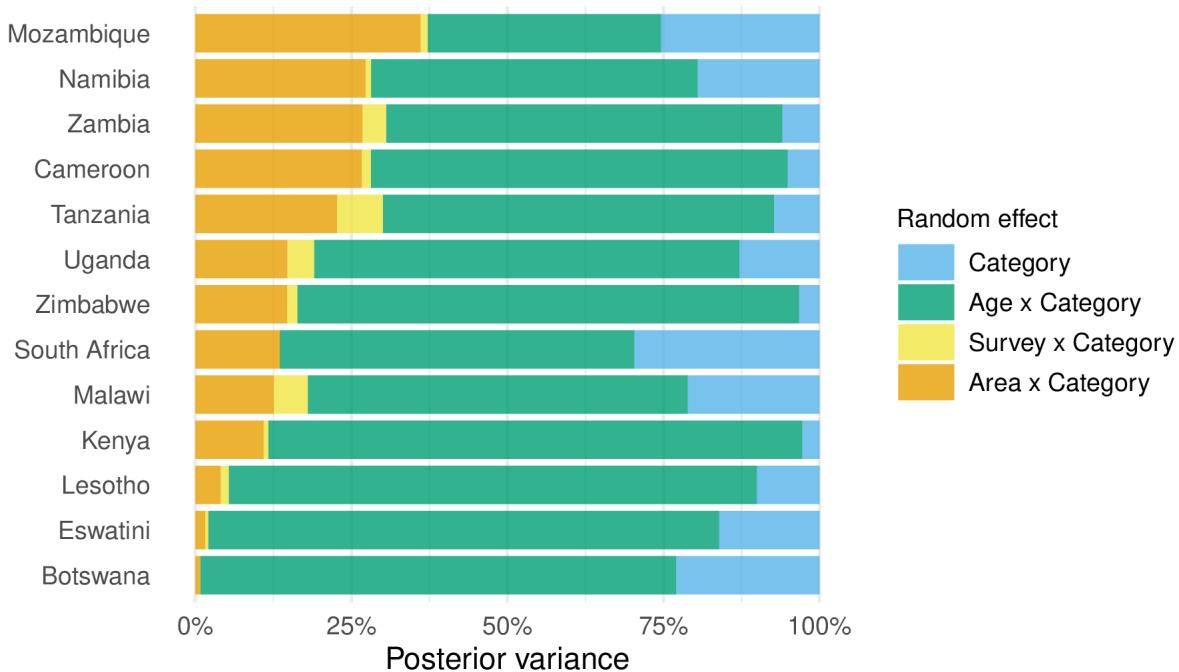


Figure B.3: Proportion of variance explained by each random effect (Sobol' indices) when the multinomial regression model is fit to each country individually. In this setting, country-category random effects are not included in the model and year-category random effects are replaced by survey-category random effects (for countries with surveys in multiple years). Countries are ordered by the proportion of their variance which is explained by the area-category random effects.

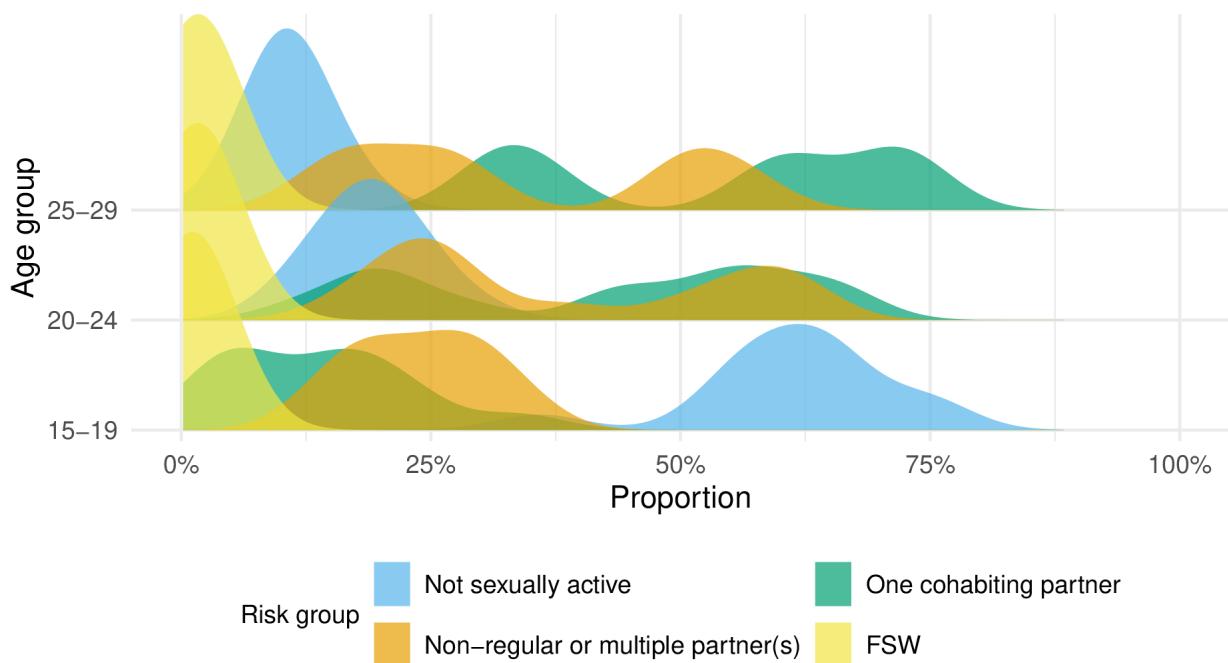


Figure B.4: The posterior density of national-level risk group proportions by age, illustrating the bi-modality of the cohabiting partner and non-regular and multiple partner(s) risk groups.

## Country-specific figures

### Comparison of direct and modelled risk group estimates

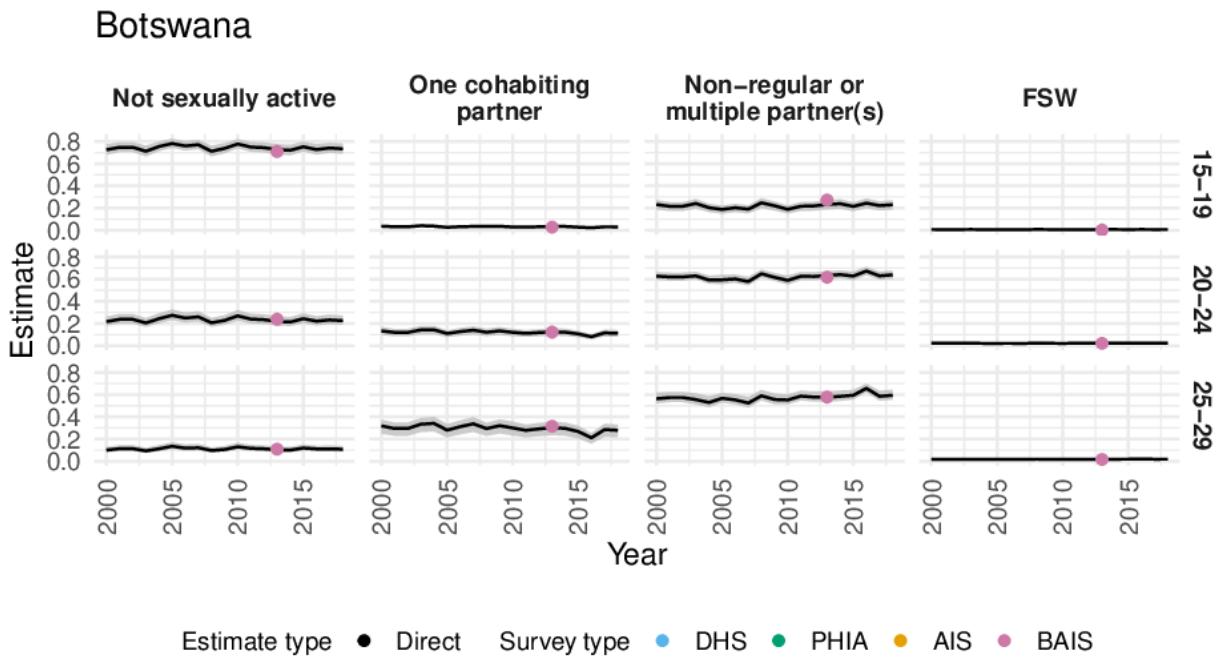


Figure B.5: Comparison of modelled and direct national-level estimates in 1999-2018 in Botswana. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Cameroon

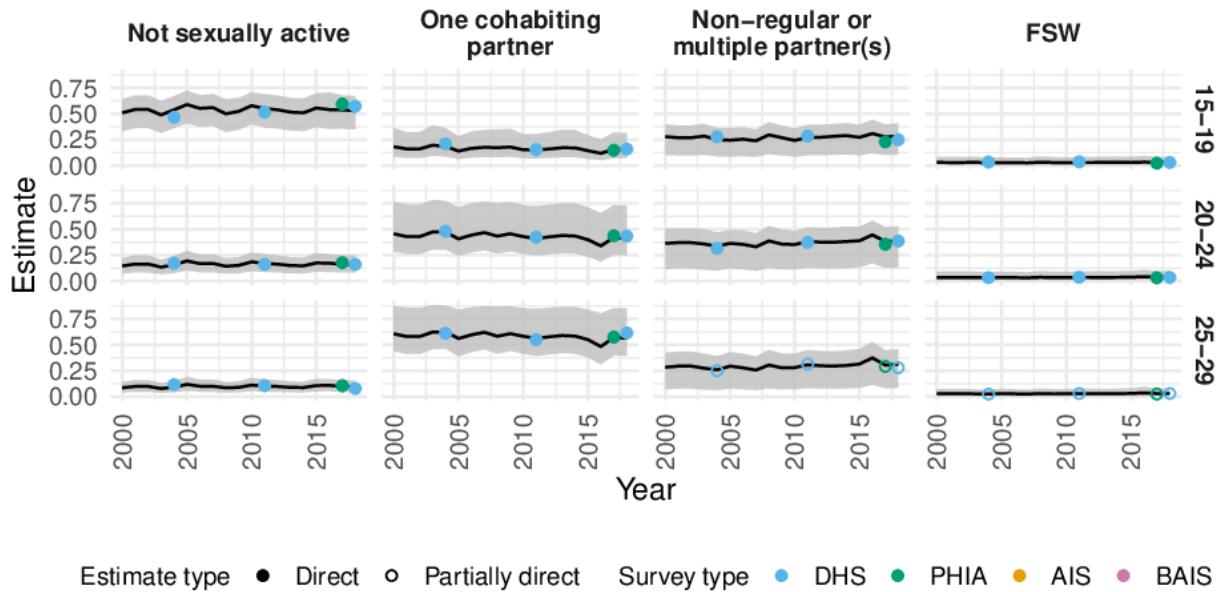


Figure B.6: Comparison of modelled and direct national-level estimates in 1999-2018 in Cameroon. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Kenya

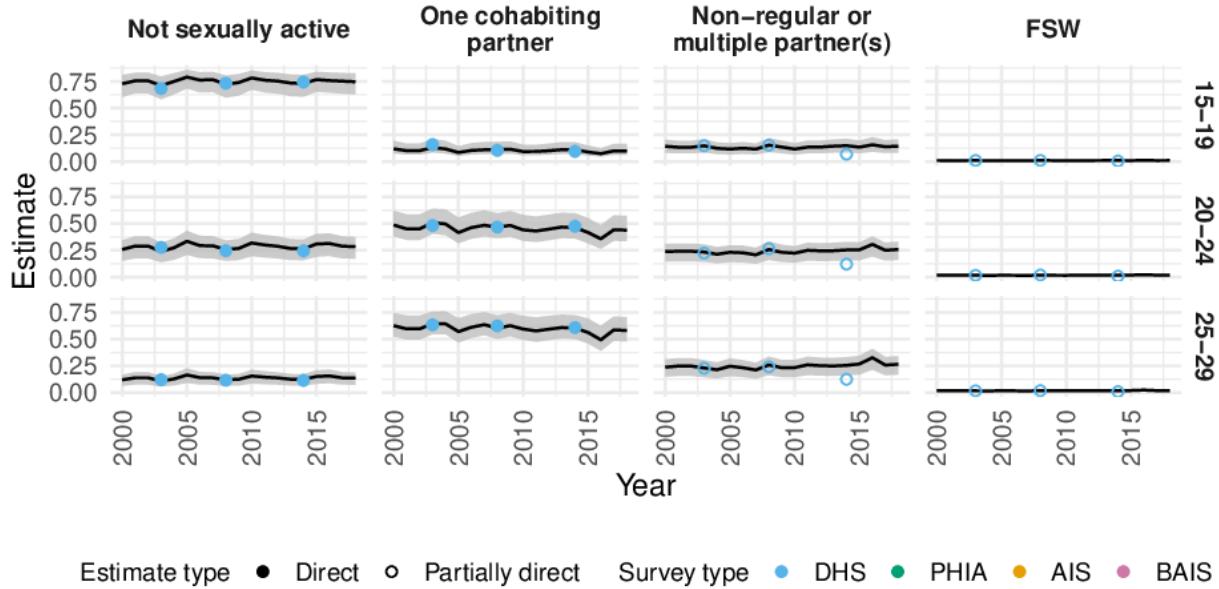


Figure B.7: Comparison of modelled and direct national-level estimates in 1999-2018 in Kenya. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Lesotho

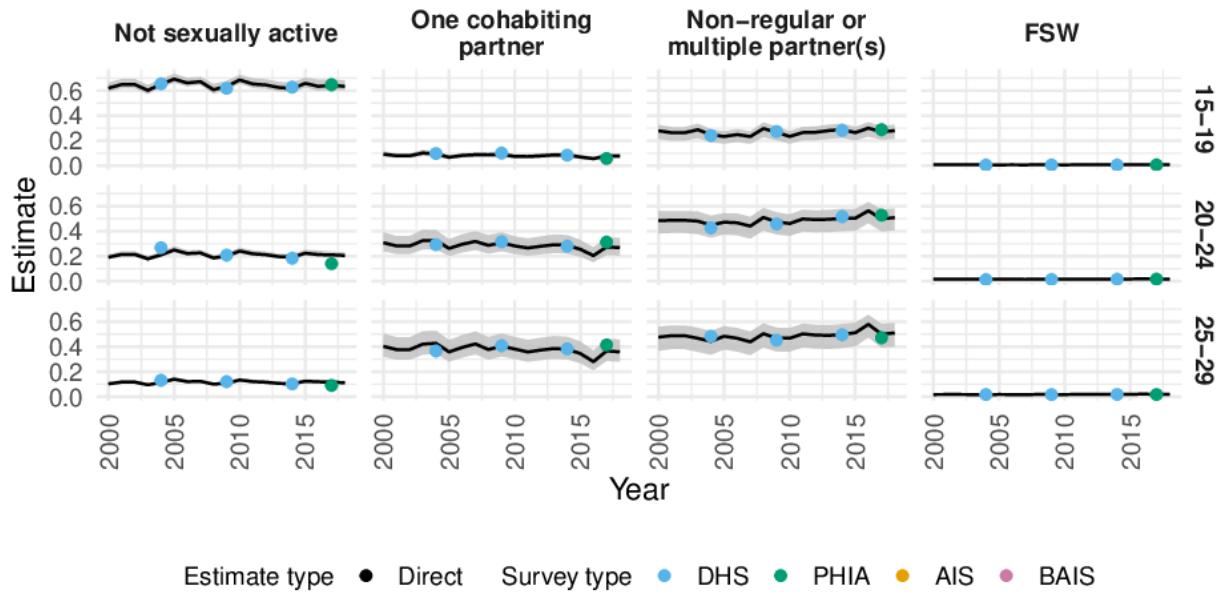


Figure B.8: Comparison of modelled and direct national-level estimates in 1999-2018 in Lesotho. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Mozambique

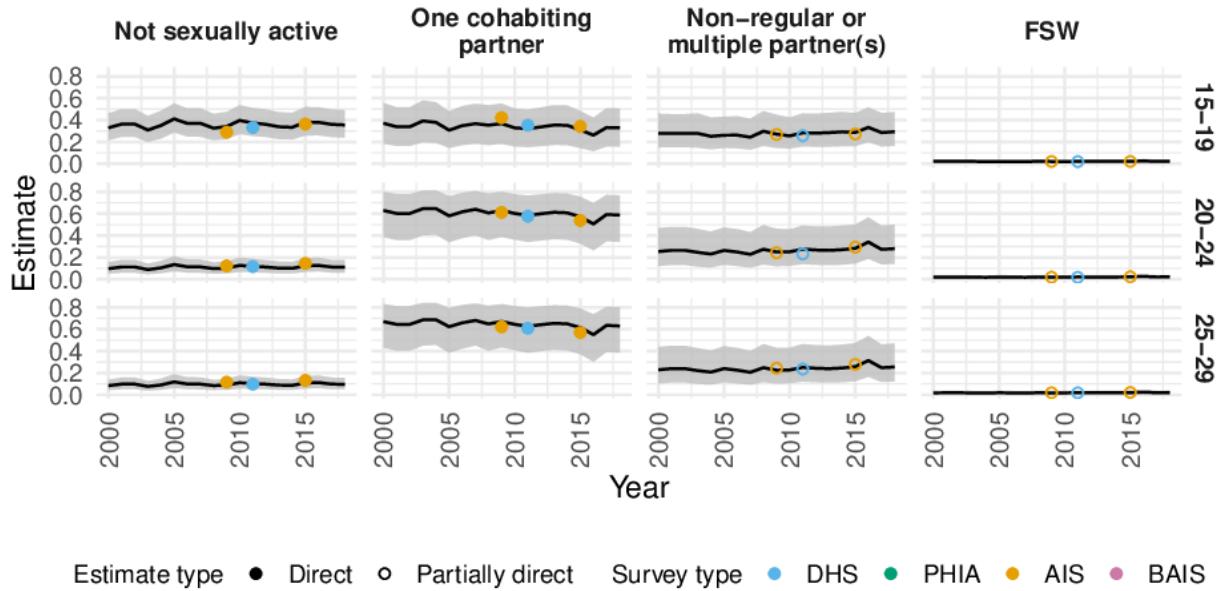


Figure B.9: Comparison of modelled and direct national-level estimates in 1999-2018 in Mozambique. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Malawi

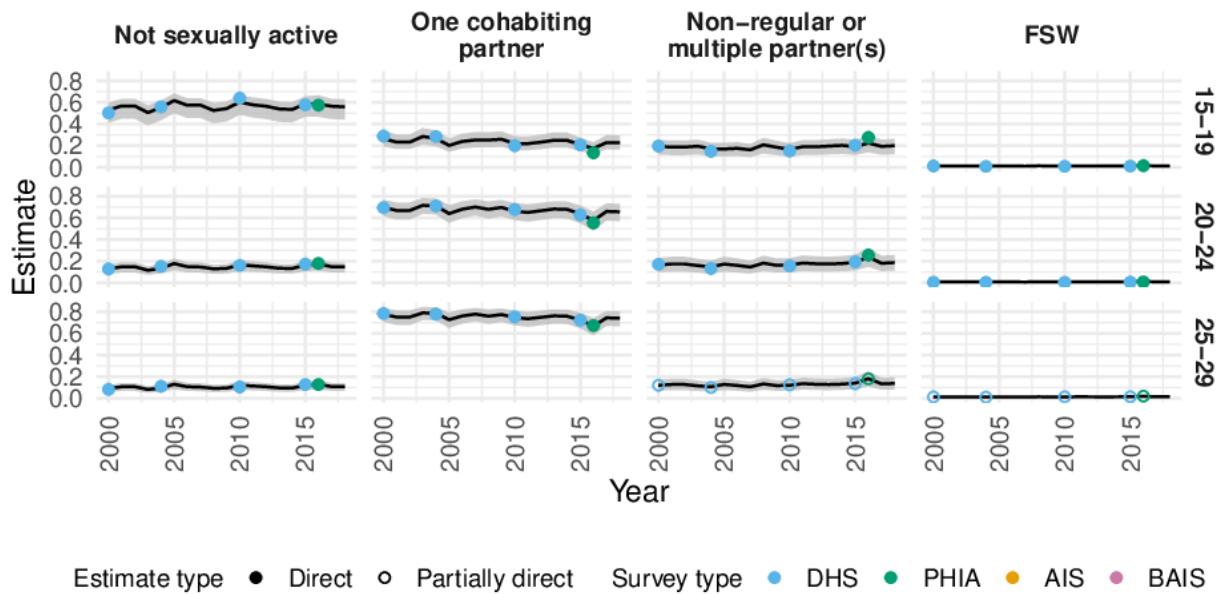


Figure B.10: Comparison of modelled and direct national-level estimates in 1999-2018 in Malawi. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Namibia

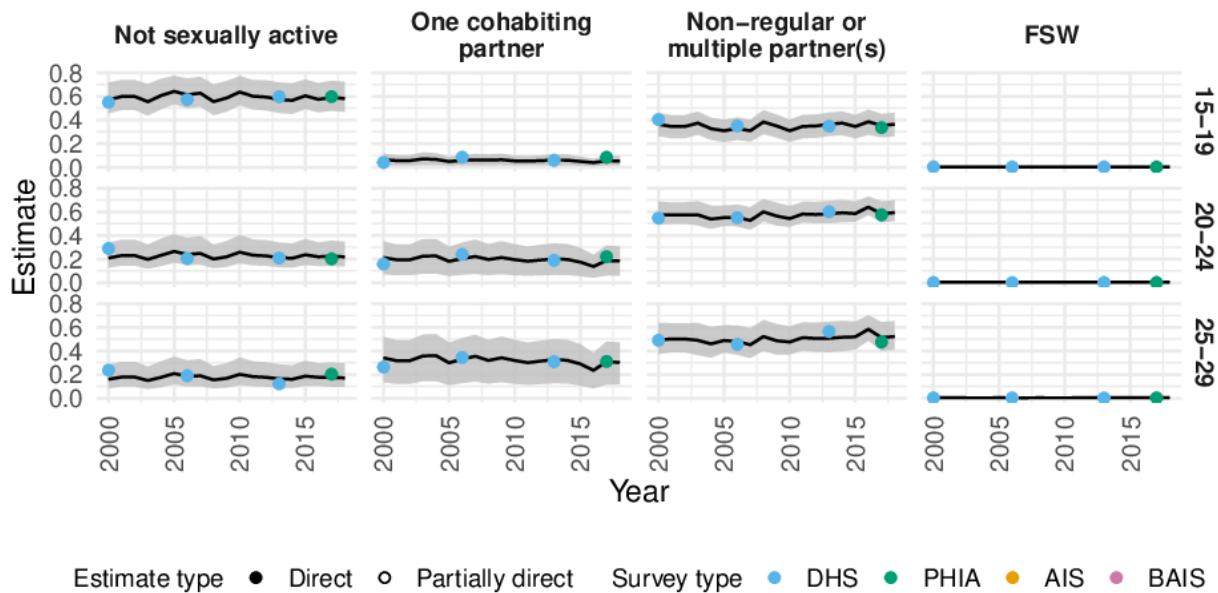


Figure B.11: Comparison of modelled and direct national-level estimates in 1999-2018 in Namibia. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Eswatini

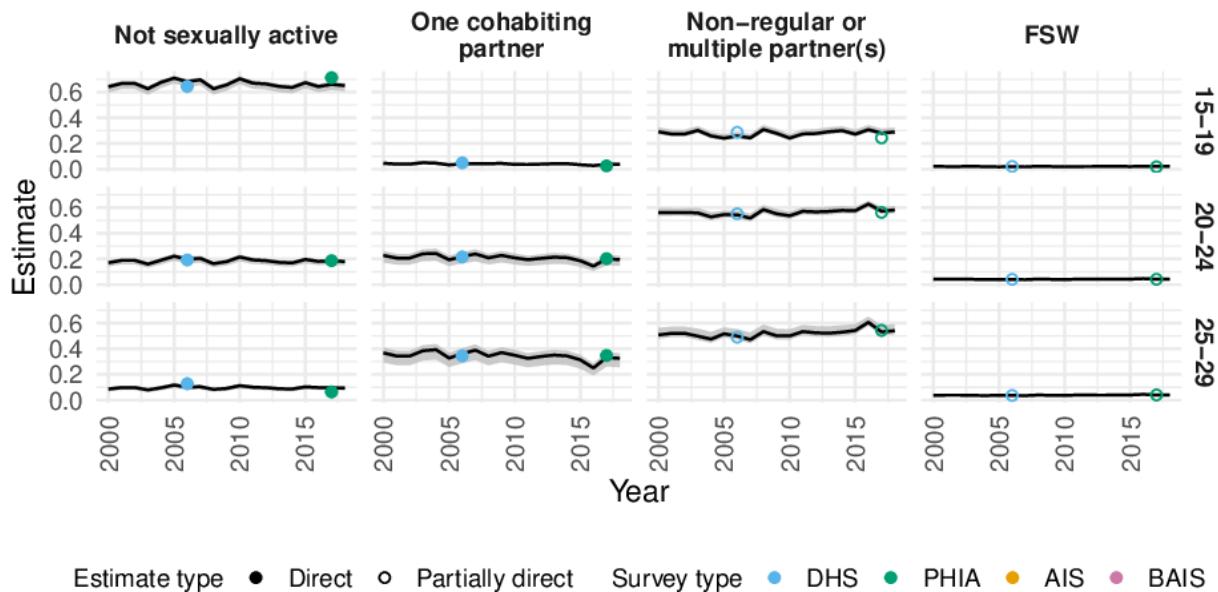


Figure B.12: Comparison of modelled and direct national-level estimates in 1999-2018 in Eswatini. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Tanzania

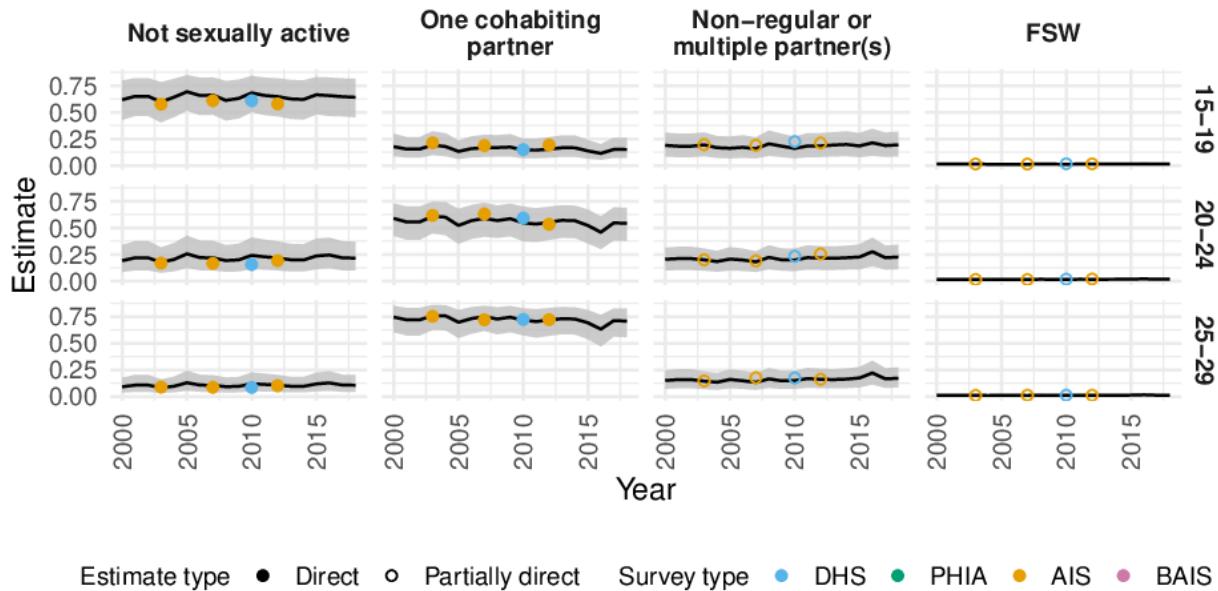


Figure B.13: Comparison of modelled and direct national-level estimates in 1999-2018 in Tanzania. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Uganda

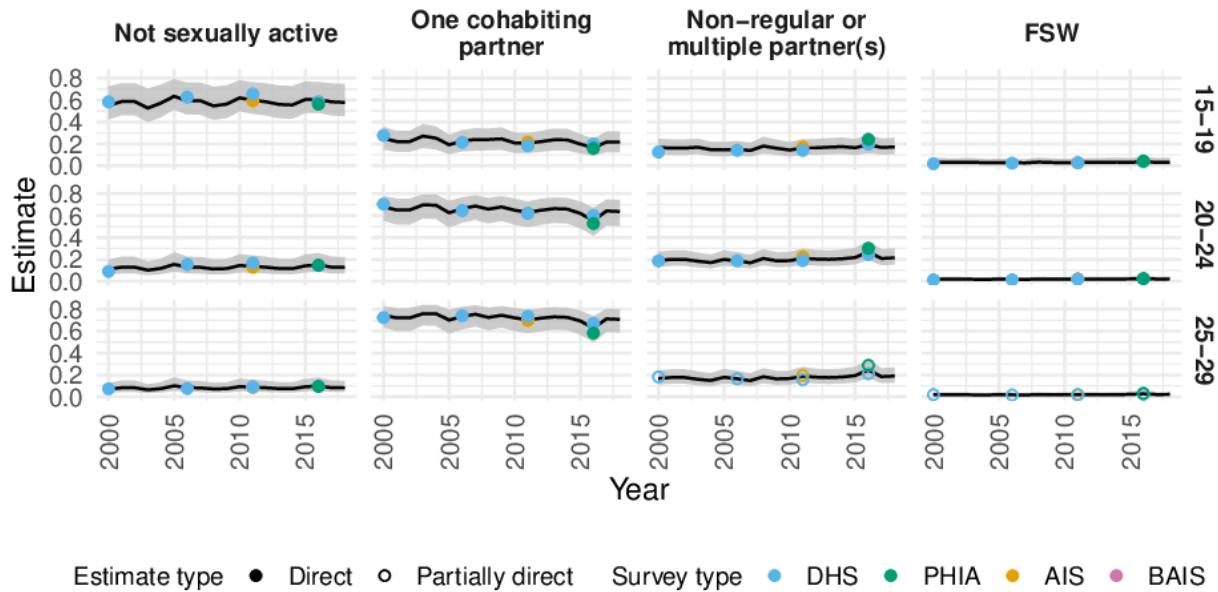


Figure B.14: Comparison of modelled and direct national-level estimates in 1999–2018 in Uganda. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## South Africa

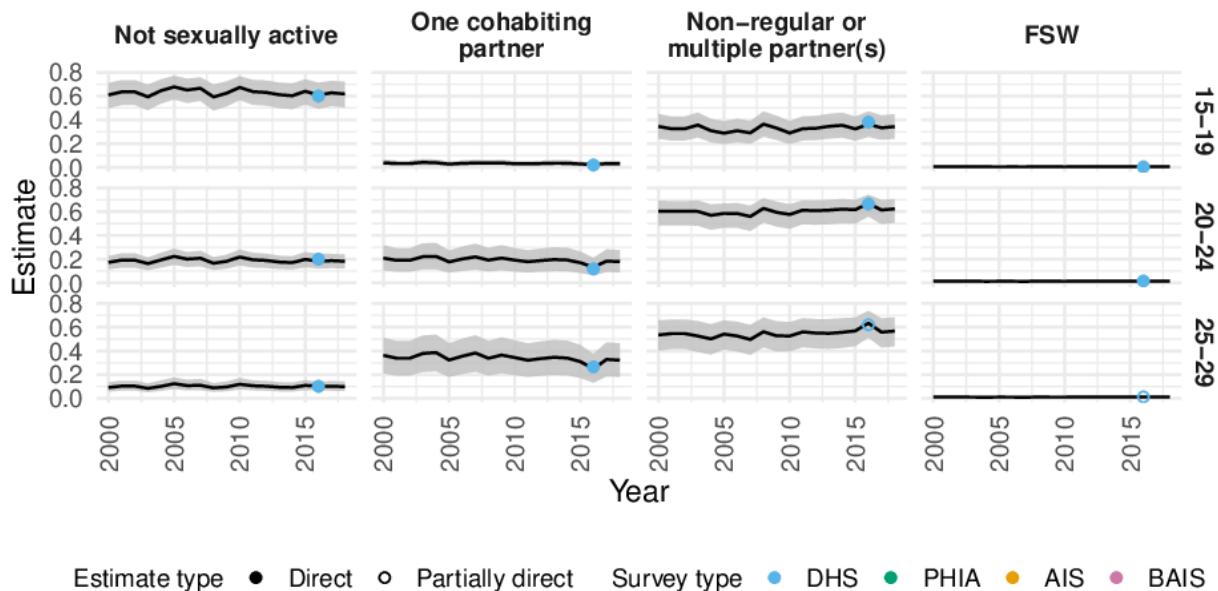


Figure B.15: Comparison of modelled and direct national-level estimates in 1999–2018 in South Africa. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Zambia

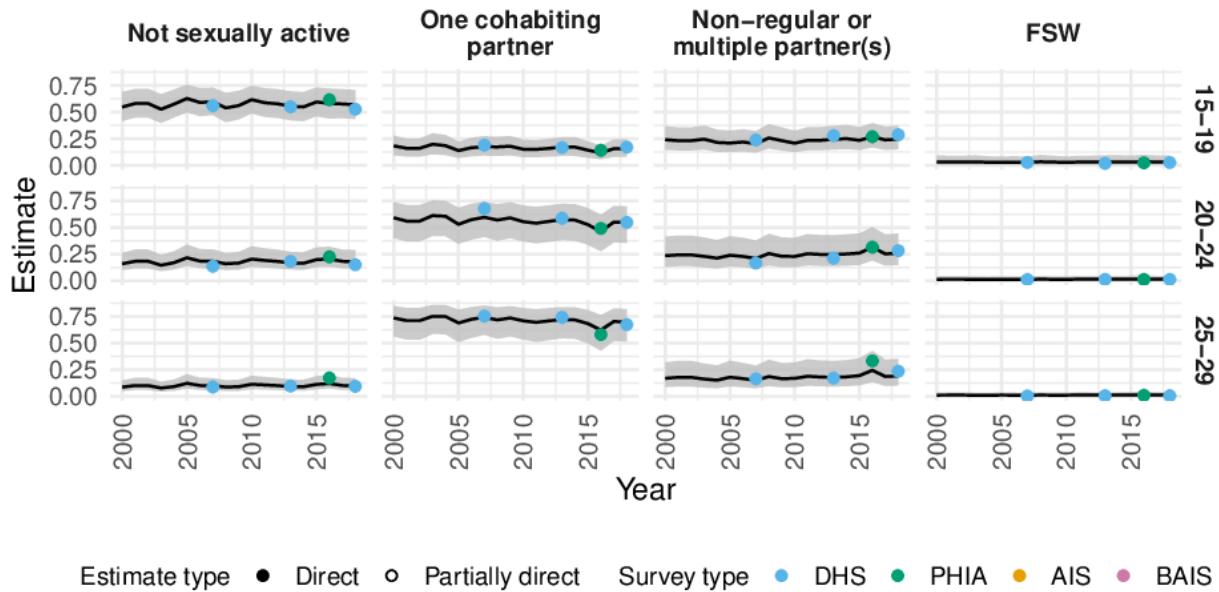


Figure B.16: Comparison of modelled and direct national-level estimates in 1999-2018 in Zambia. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## Zimbabwe

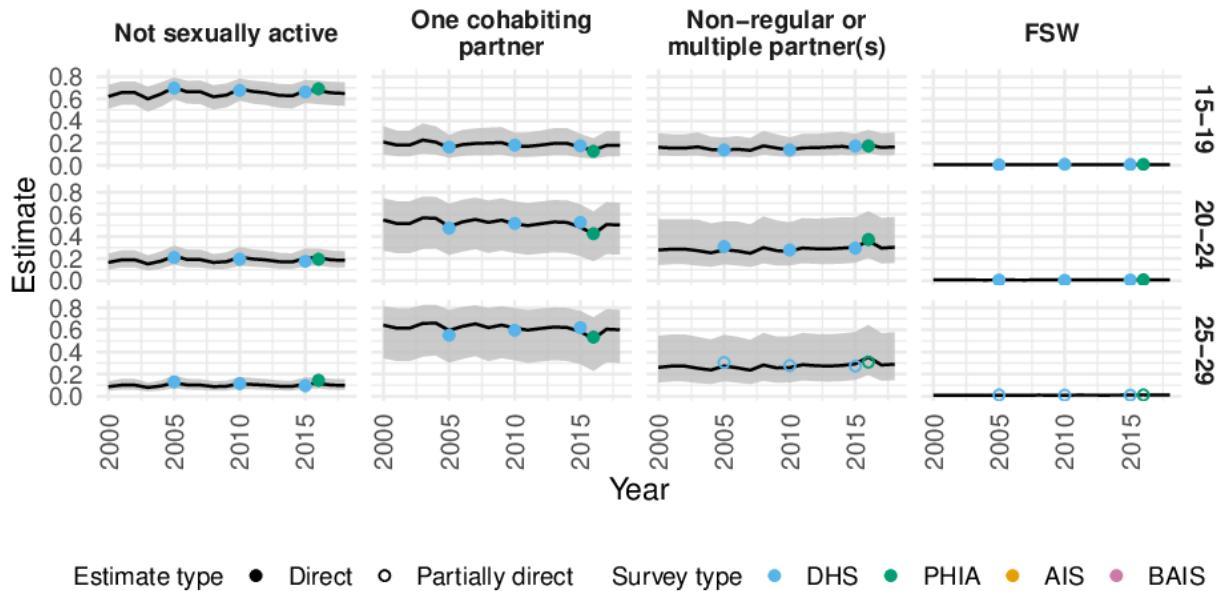


Figure B.17: Comparison of modelled and direct national-level estimates in 1999-2018 in Zimbabwe. Estimates are described as "partially direct" when there are no surveys containing a transactional sex question in a country-age-group and we instead used modelled logistic regression estimates to differentiate the direct estimates.

## HIV prevalence

## Botswana

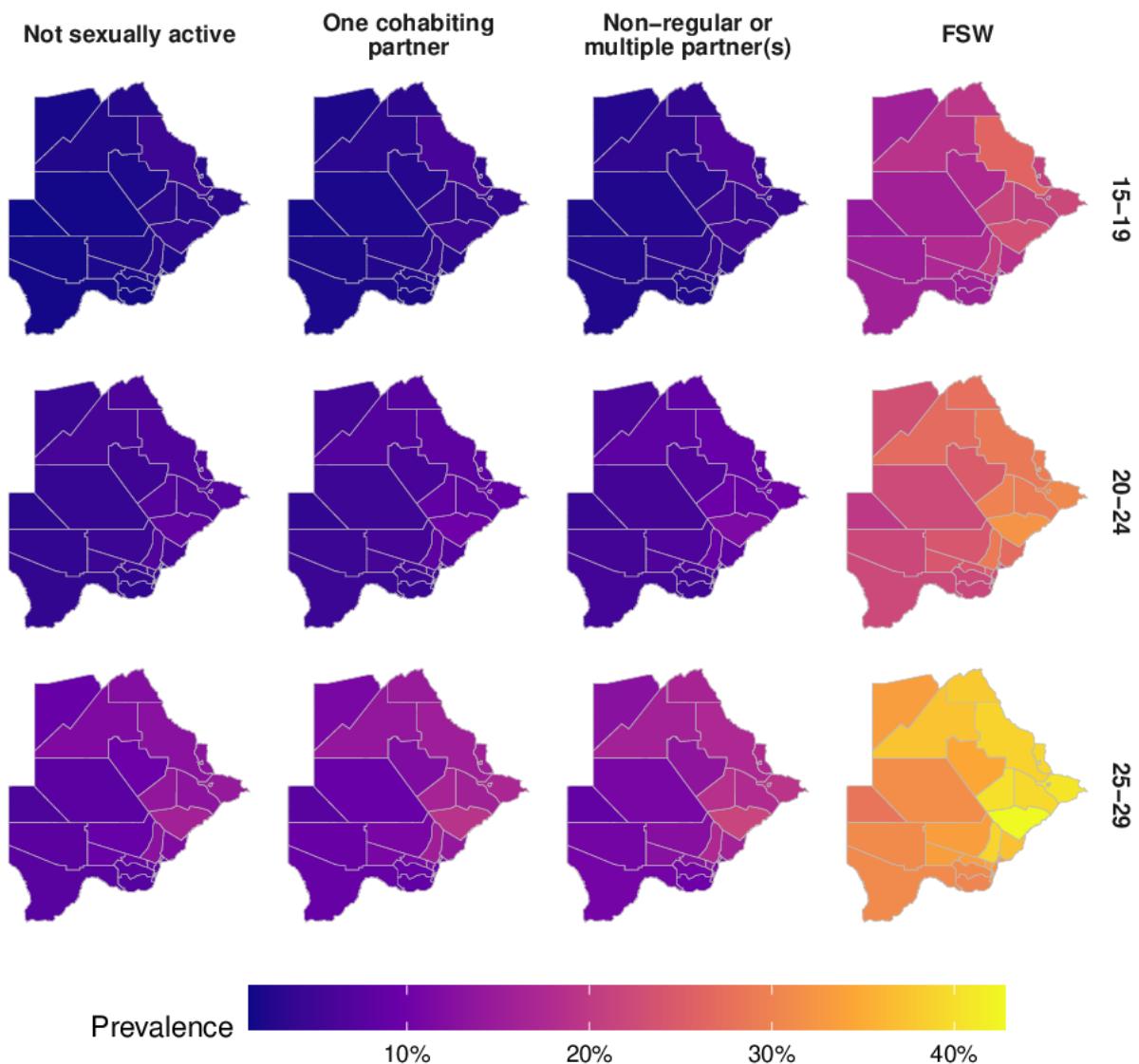


Figure B.18: District-level HIV prevalence for each of the risk groups in 2018 in Botswana.

## Cameroon

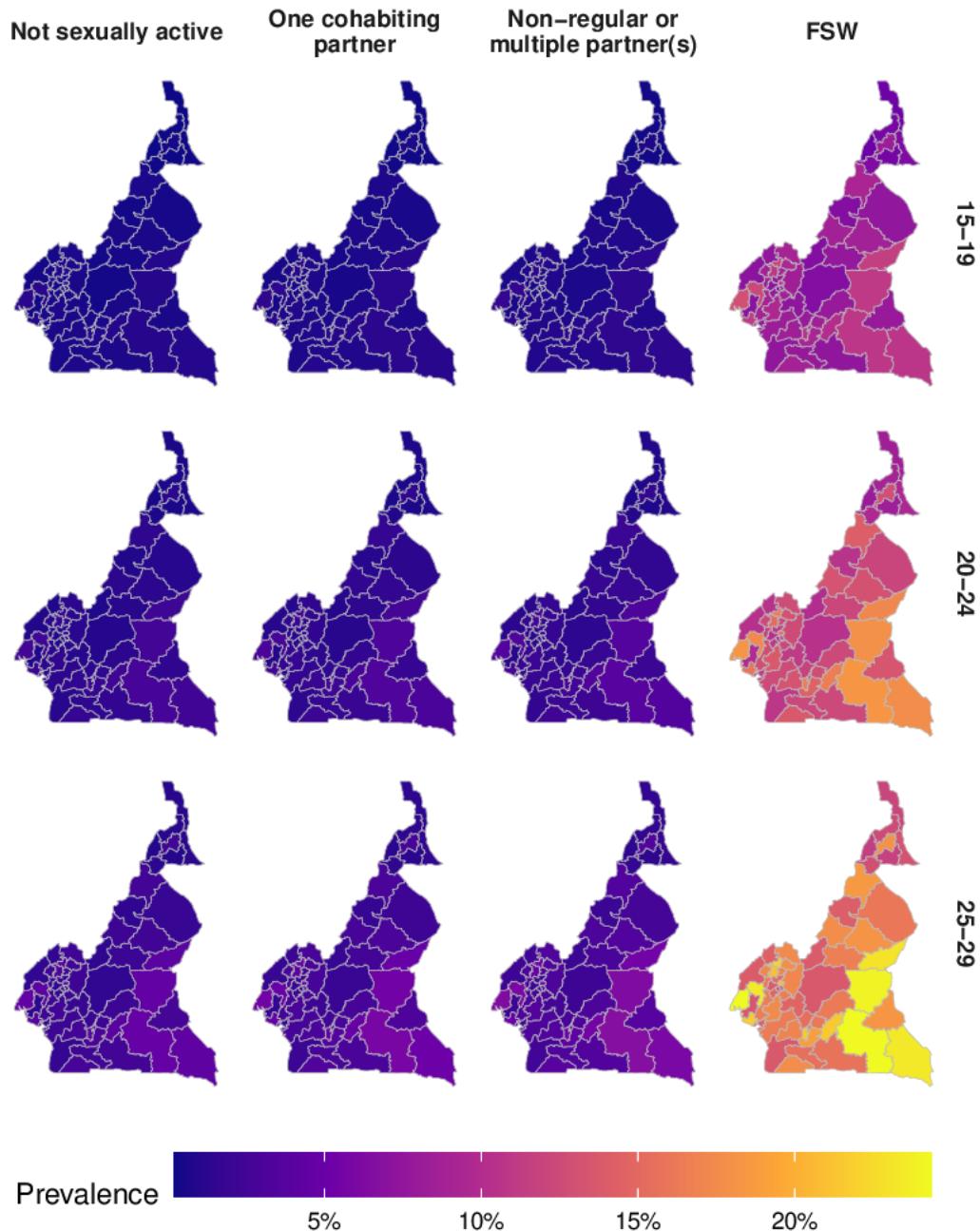


Figure B.19: District-level HIV prevalence for each of the risk groups in 2018 in Cameroon.

## Kenya

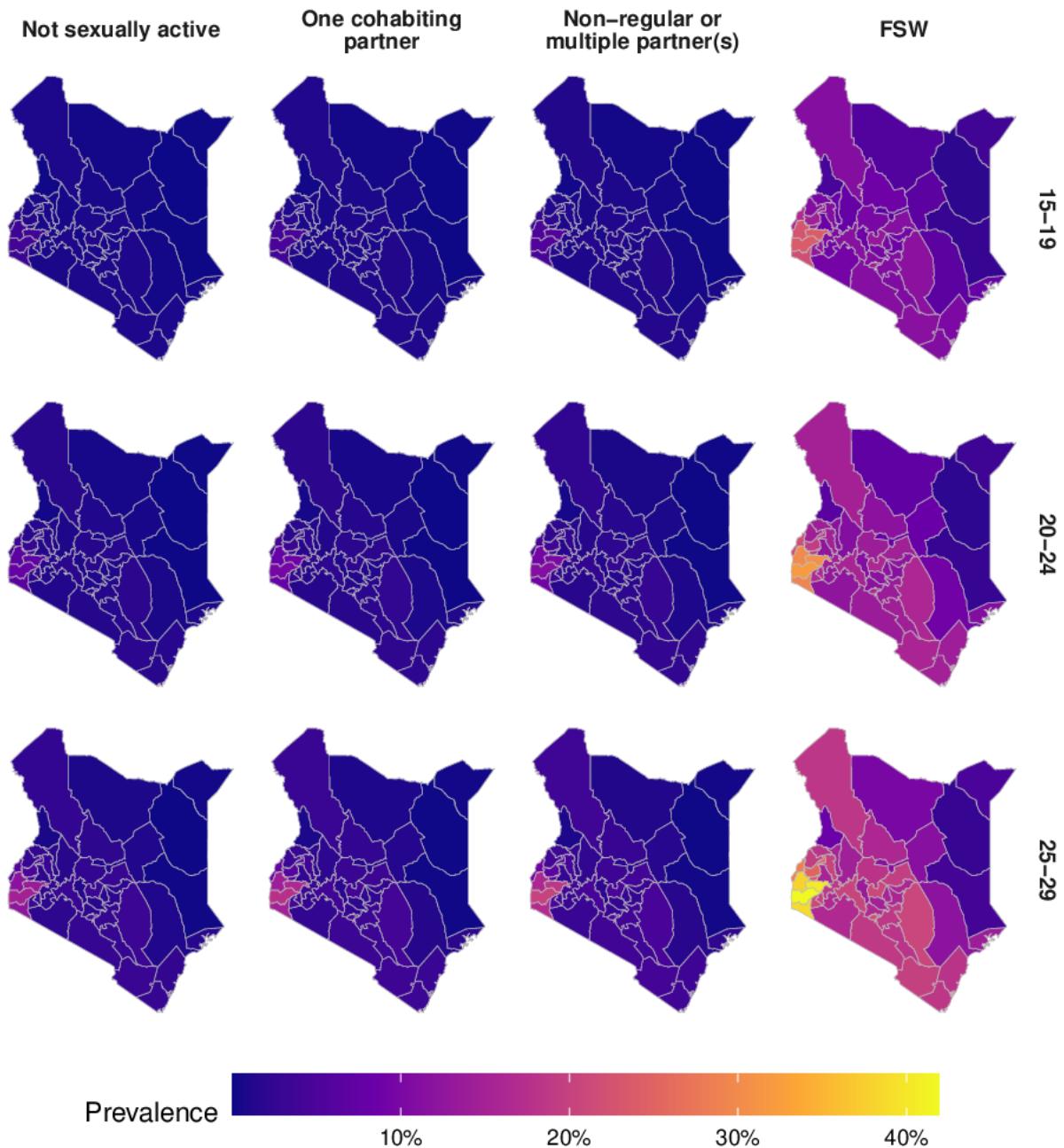


Figure B.20: District-level HIV prevalence for each of the risk groups in 2018 in Kenya.

## Lesotho

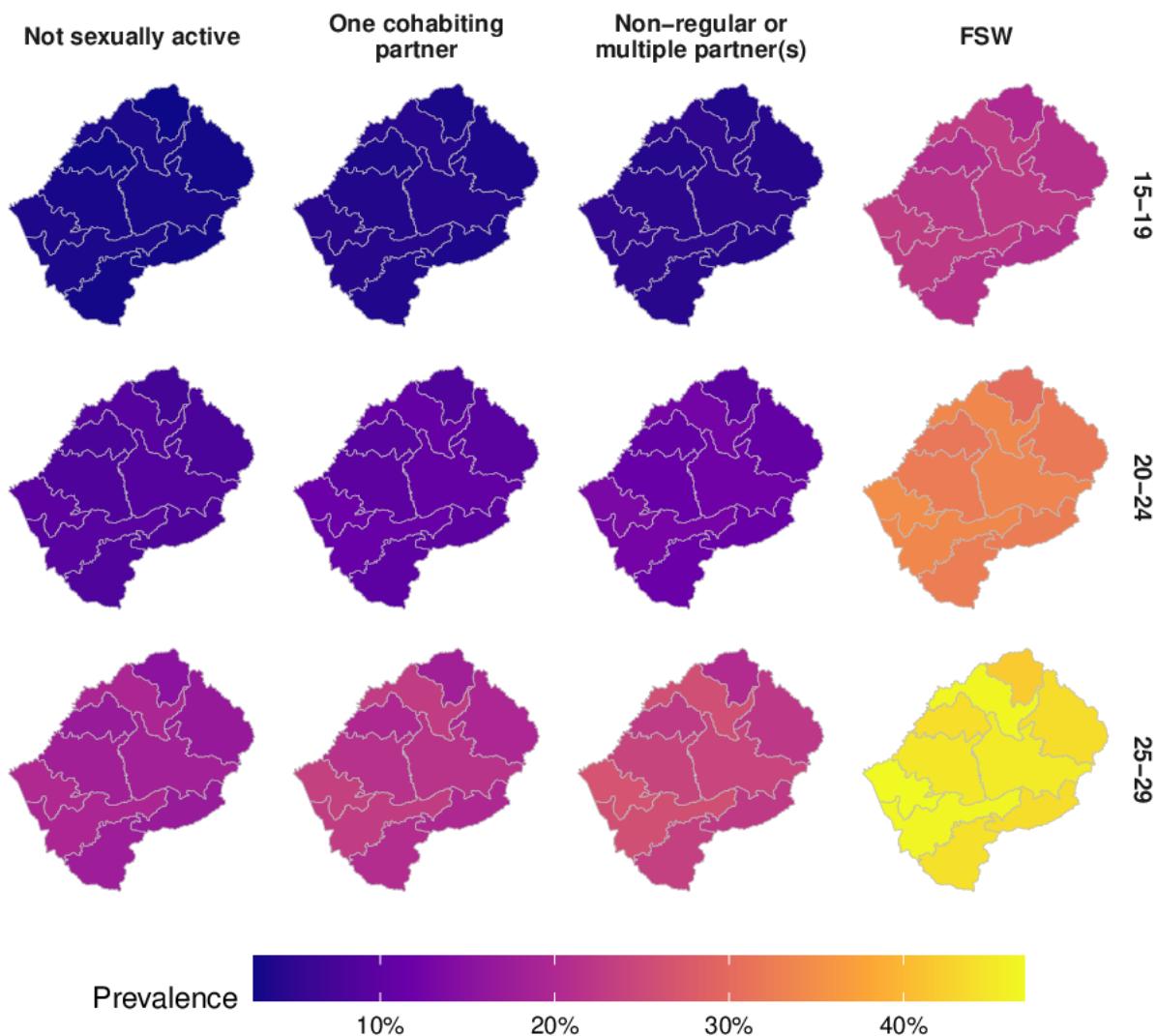


Figure B.21: District-level HIV prevalence for each of the risk groups in 2018 in Lesotho.

## Mozambique

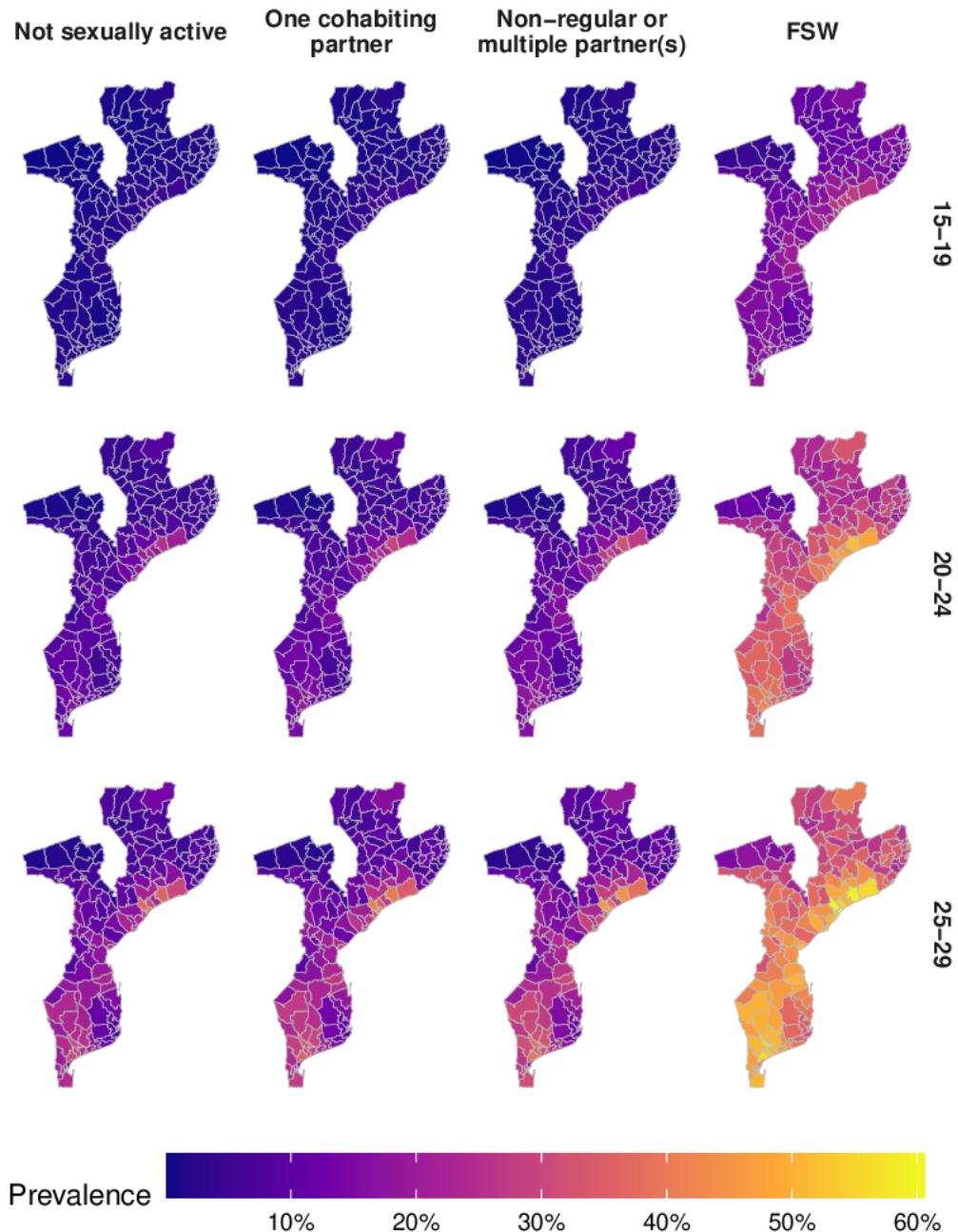


Figure B.22: District-level HIV prevalence for each of the risk groups in 2018 in Mozambique.

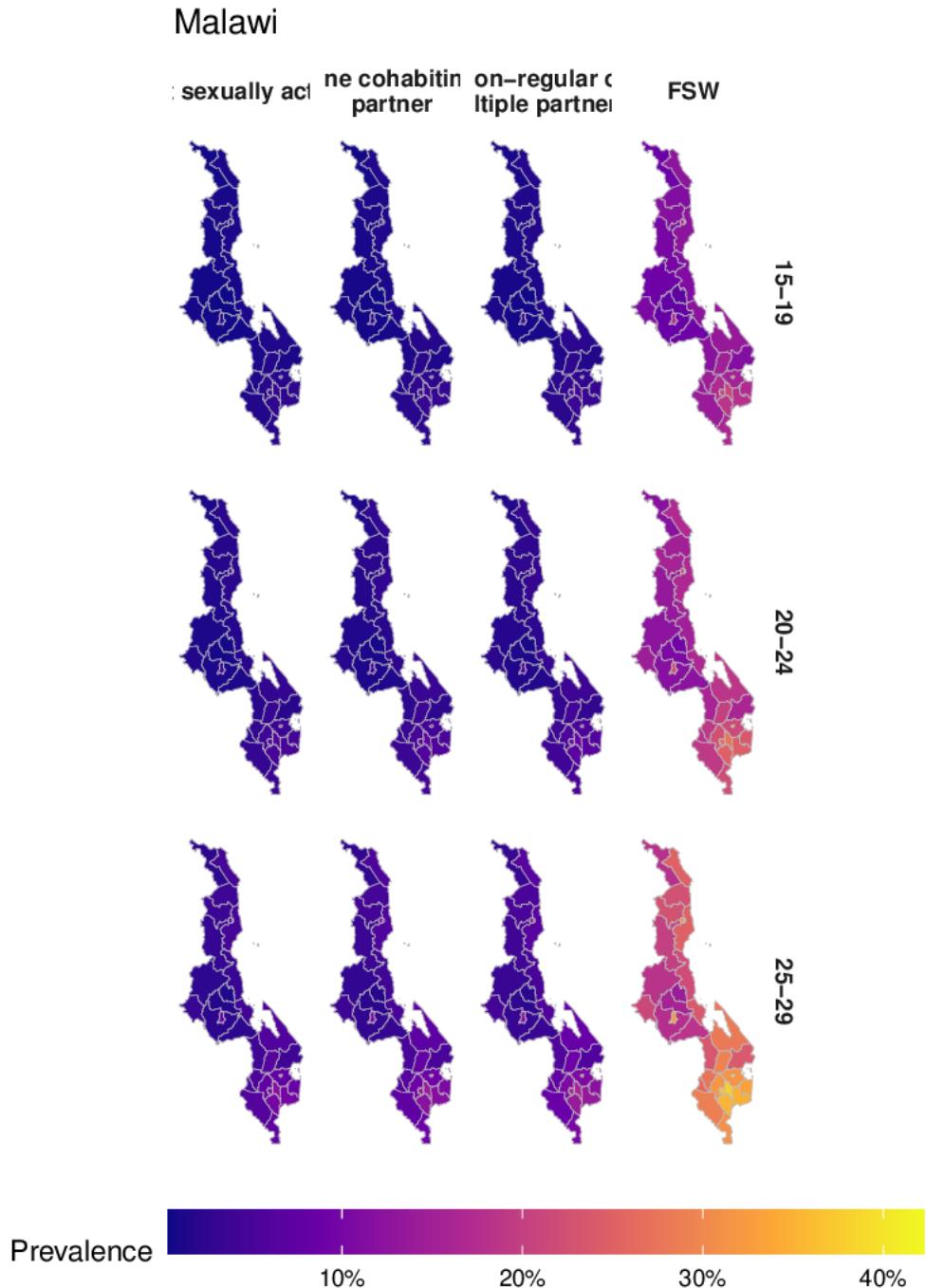


Figure B.23: District-level HIV prevalence for each of the risk groups in 2018 in Malawi.

## Namibia

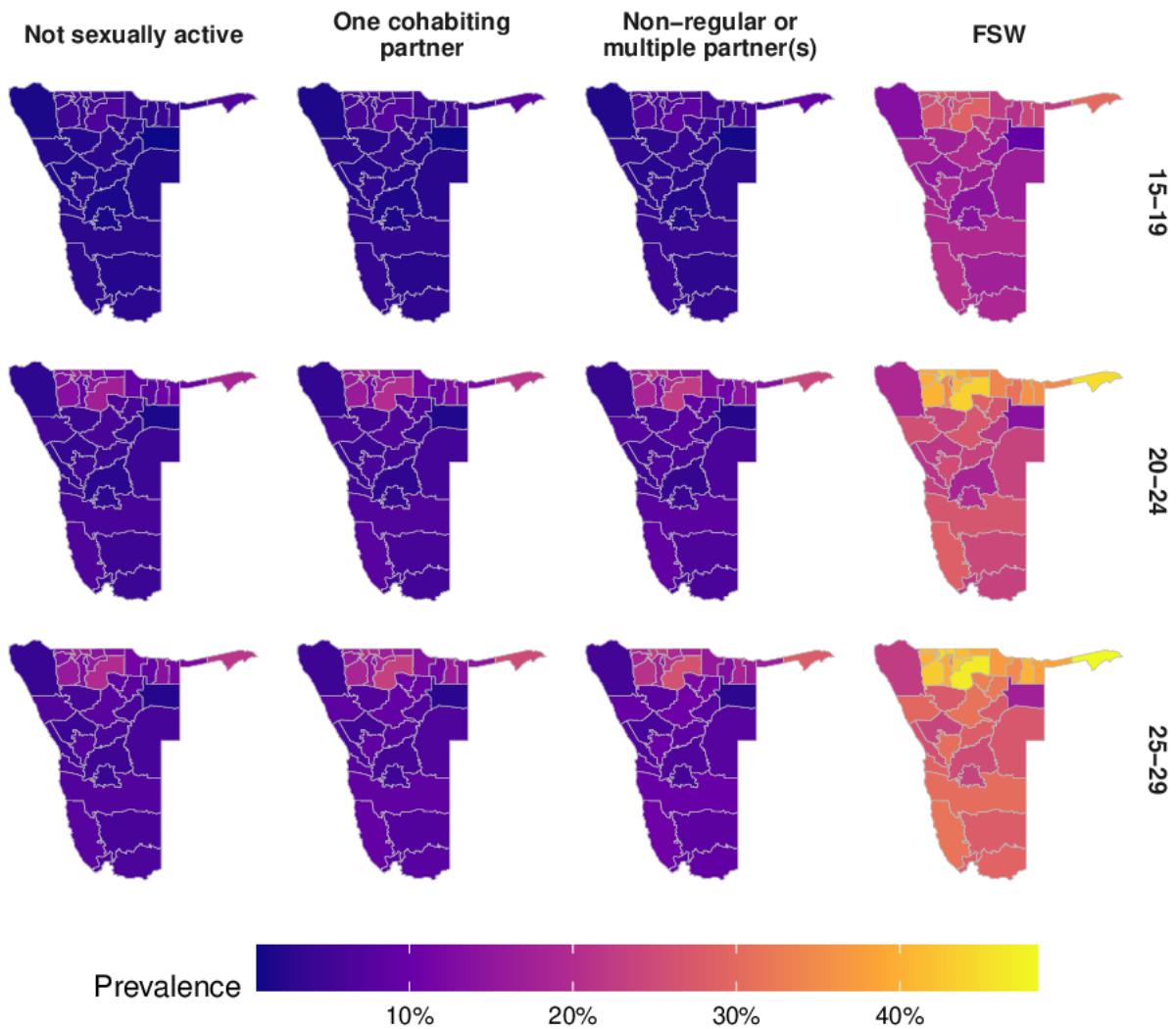


Figure B.24: District-level HIV prevalence for each of the risk groups in 2018 in Namibia.

## Eswatini

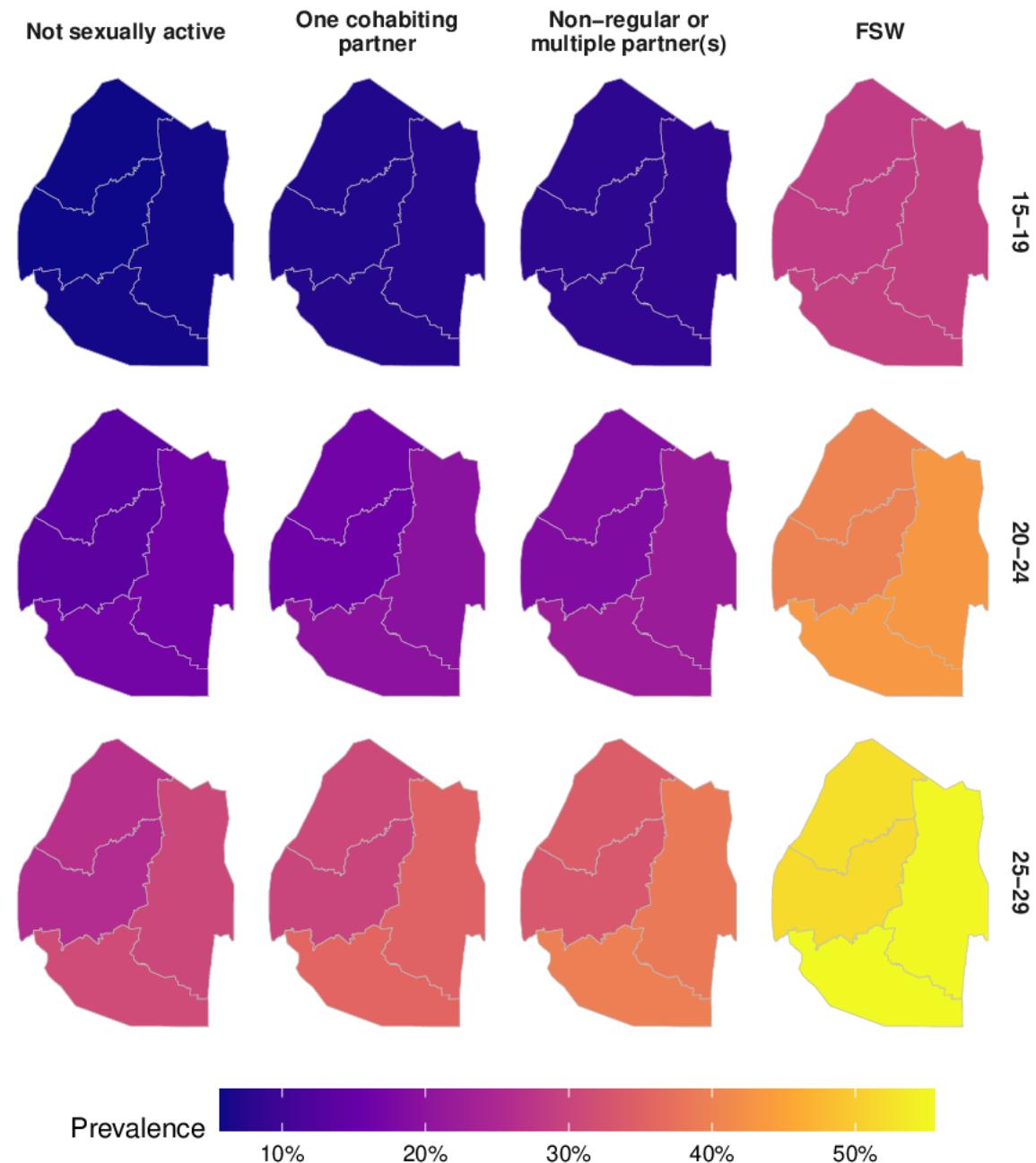


Figure B.25: District-level HIV prevalence for each of the risk groups in 2018 in Eswatini.

## Tanzania

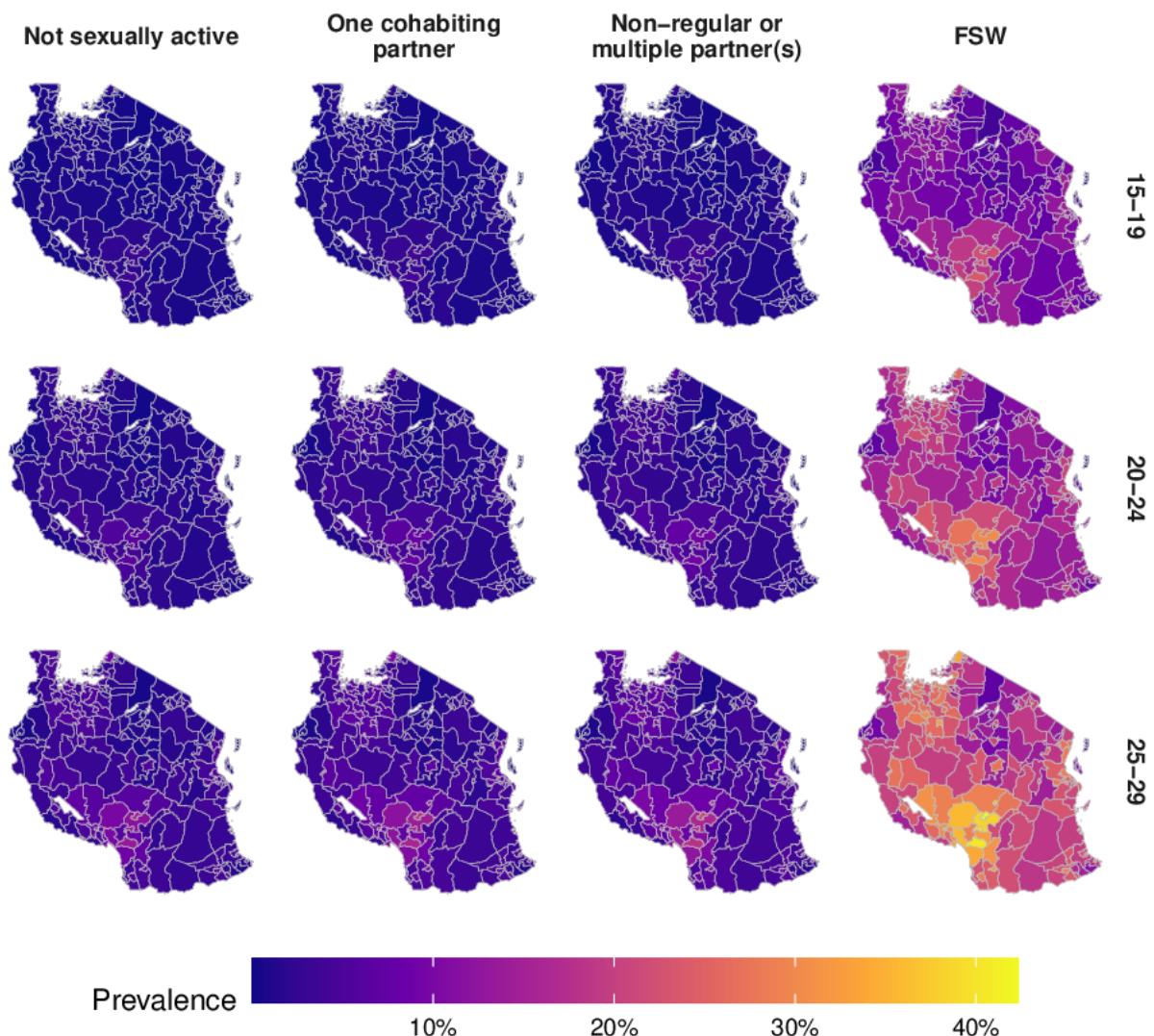


Figure B.26: District-level HIV prevalence for each of the risk groups in 2018 in Tanzania.

## Uganda

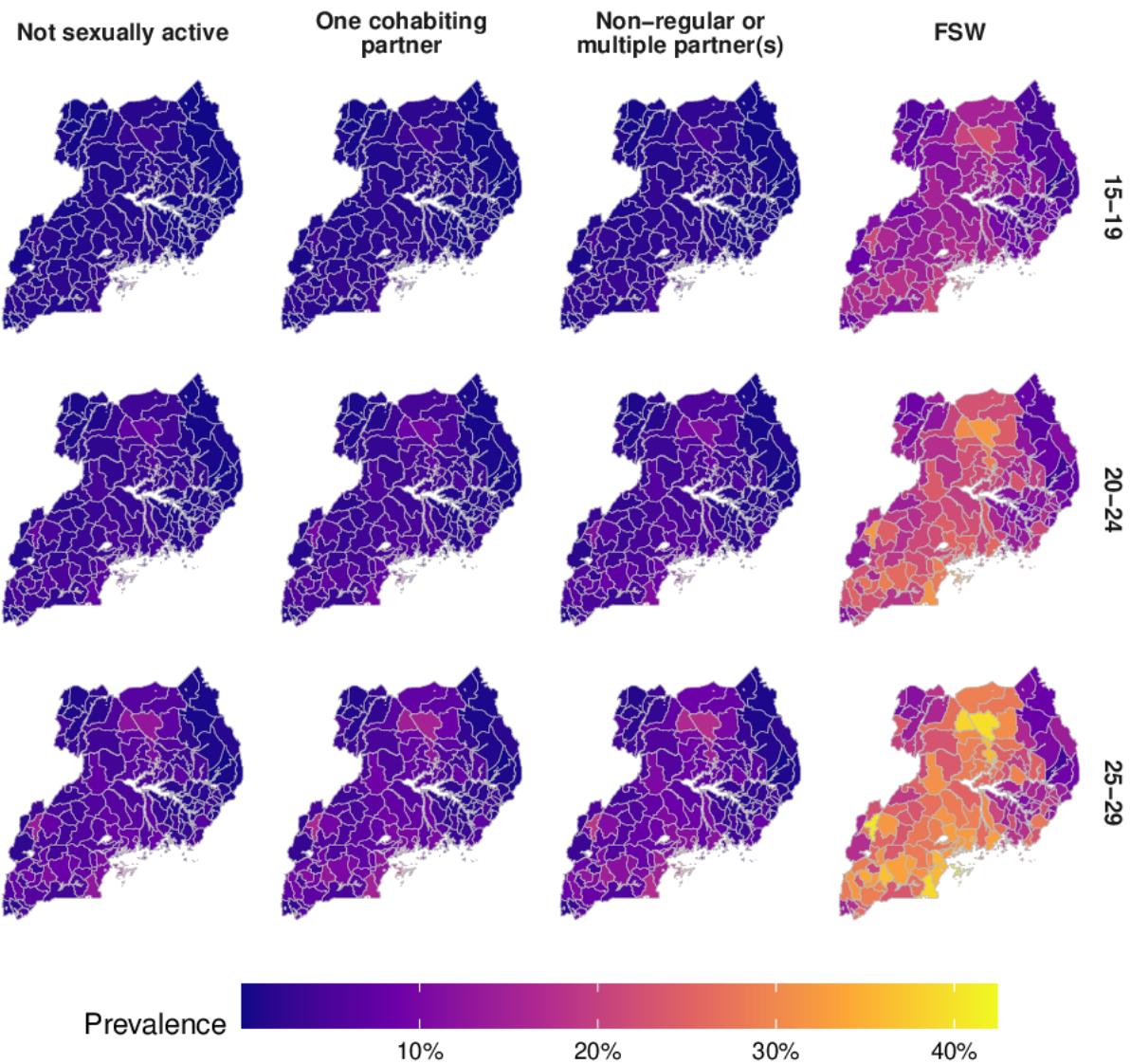


Figure B.27: District-level HIV prevalence for each of the risk groups in 2018 in Uganda.

## South Africa

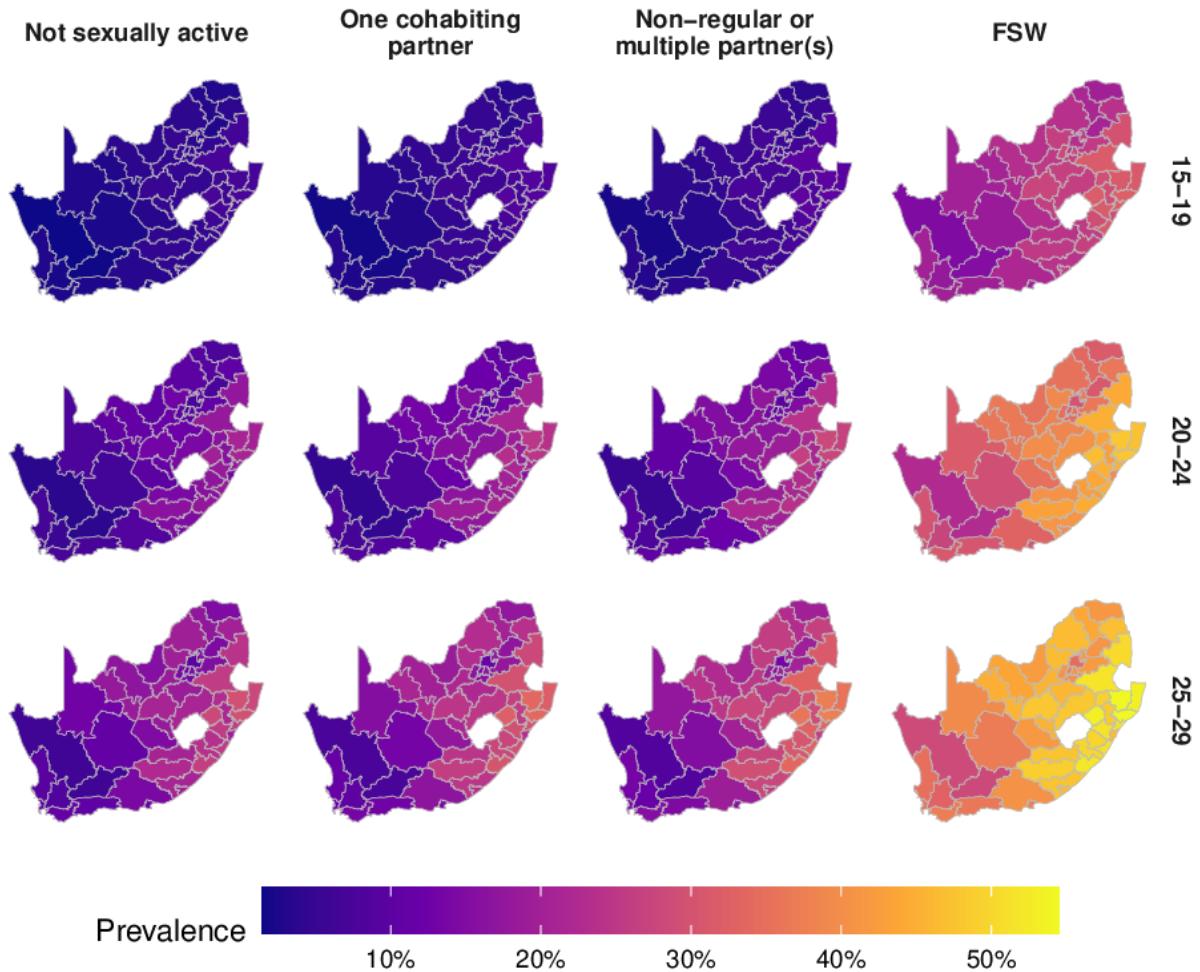


Figure B.28: District-level HIV prevalence for each of the risk groups in 2018 in South Africa.

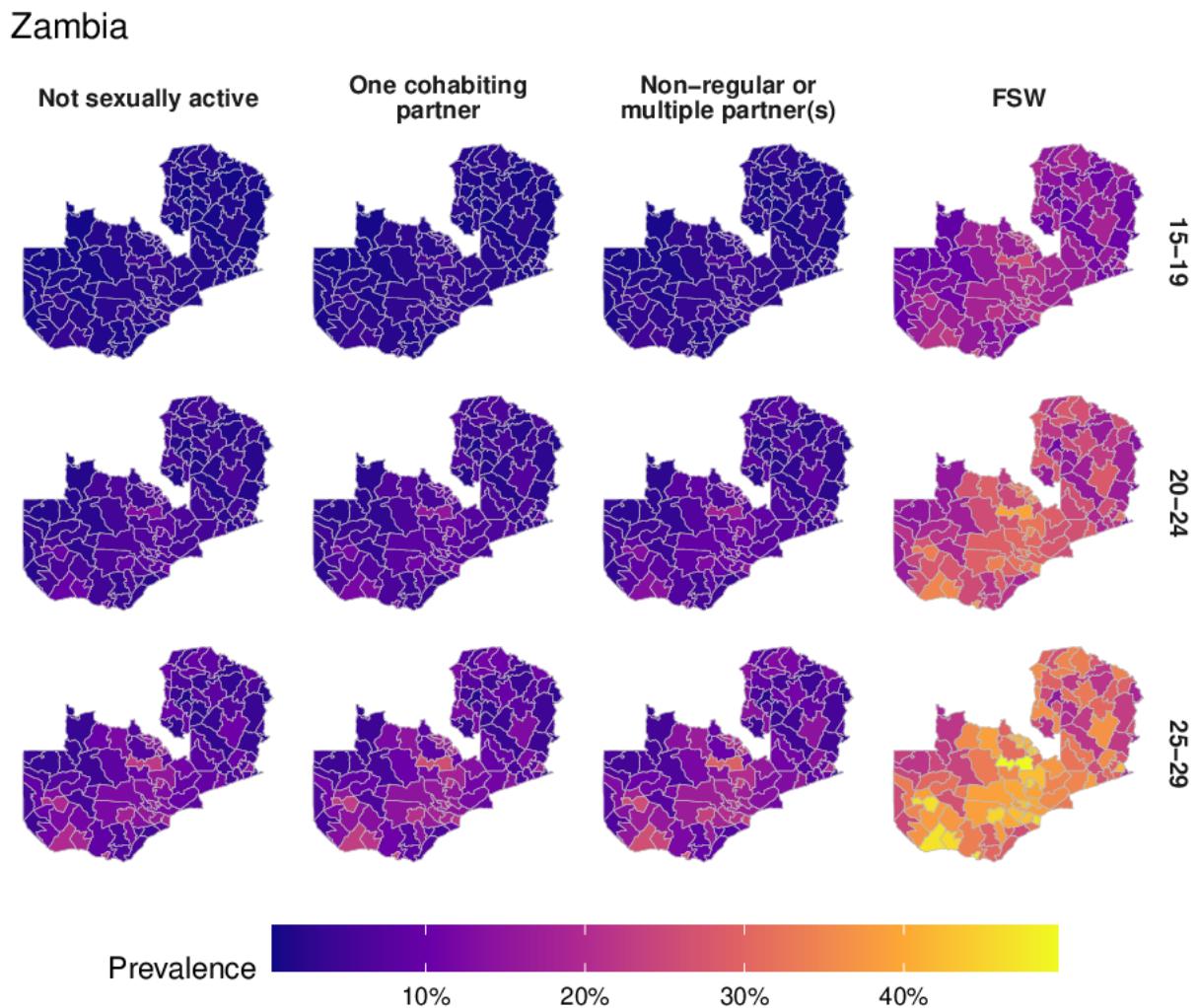


Figure B.29: District-level HIV prevalence for each of the risk groups in 2018 in Zambia.

## Zimbabwe

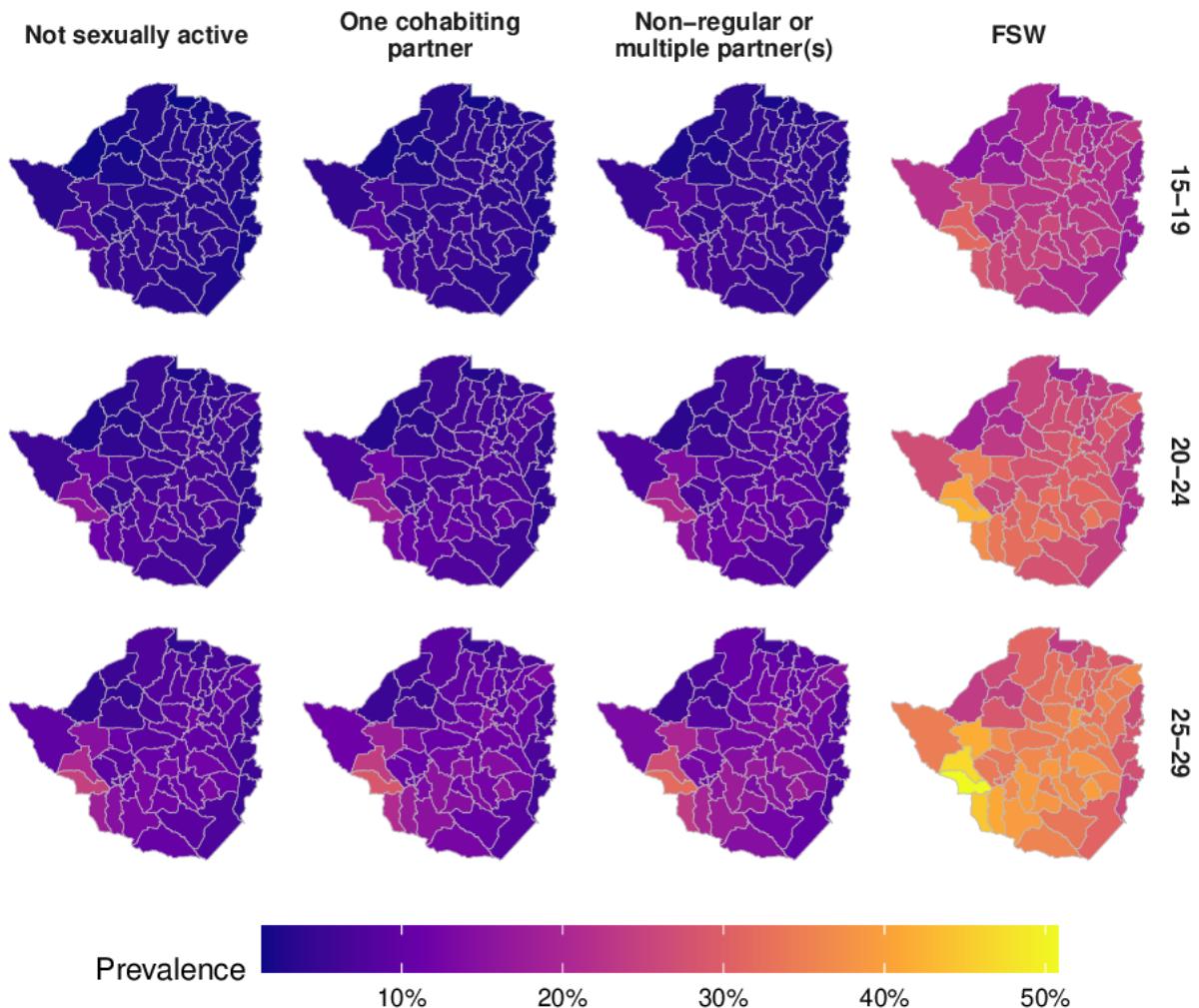


Figure B.30: District-level HIV prevalence for each of the risk groups in 2018 in Zimbabwe.

## HIV incidence

## Botswana

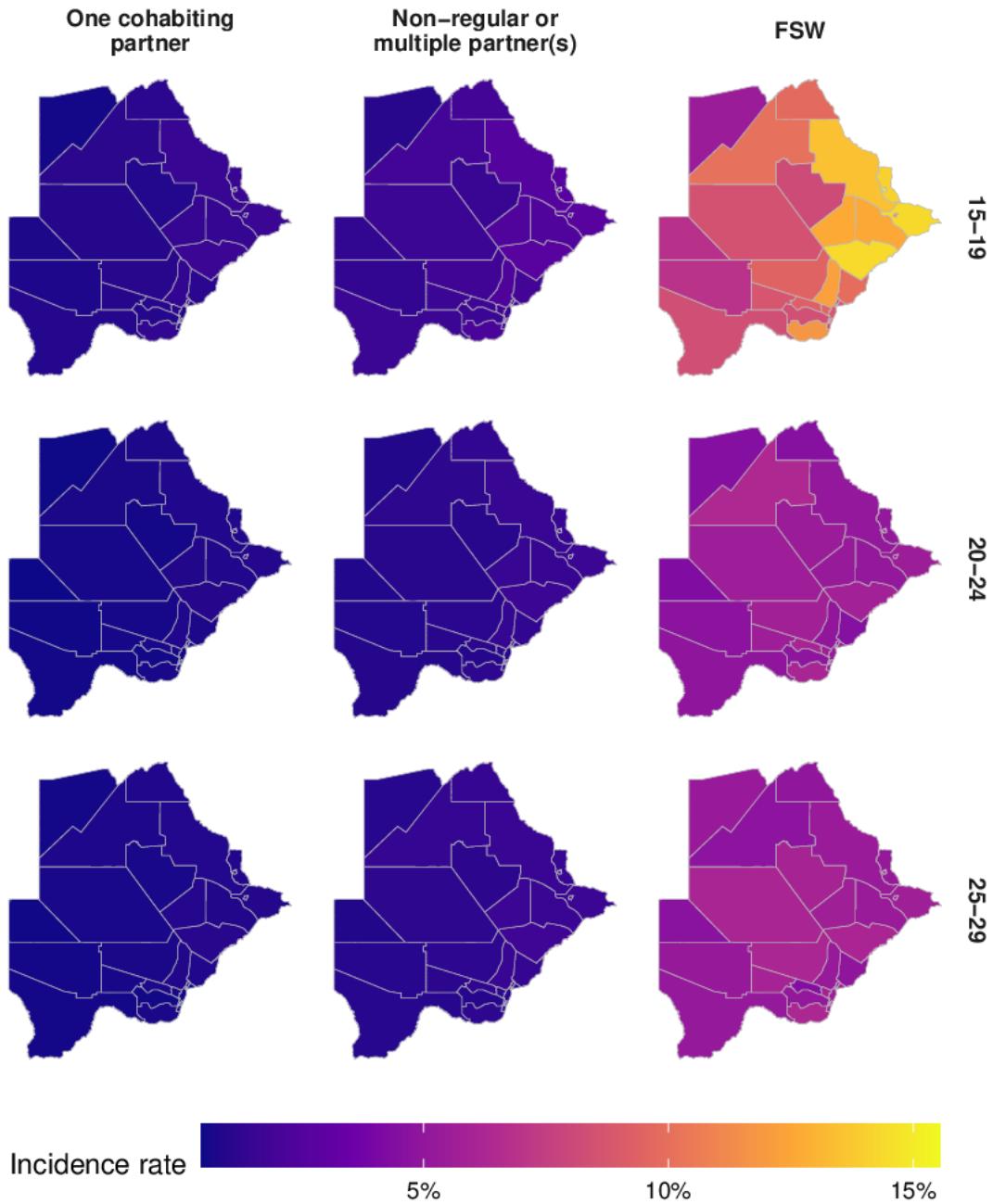


Figure B.31: District-level HIV incidence for each of the risk groups in 2018 in Botswana.

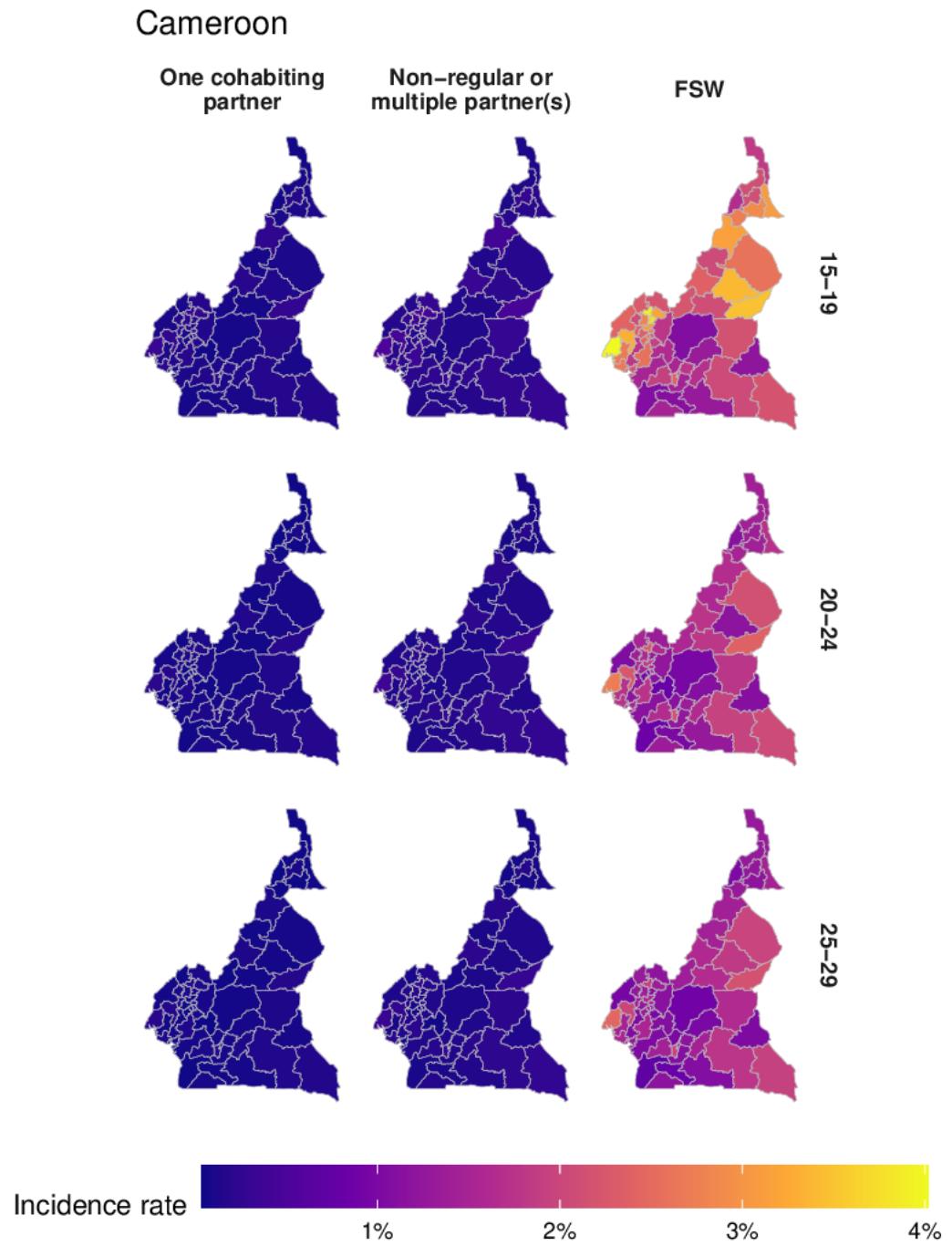


Figure B.32: District-level HIV incidence for each of the risk groups in 2018 in Cameroon.

Kenya

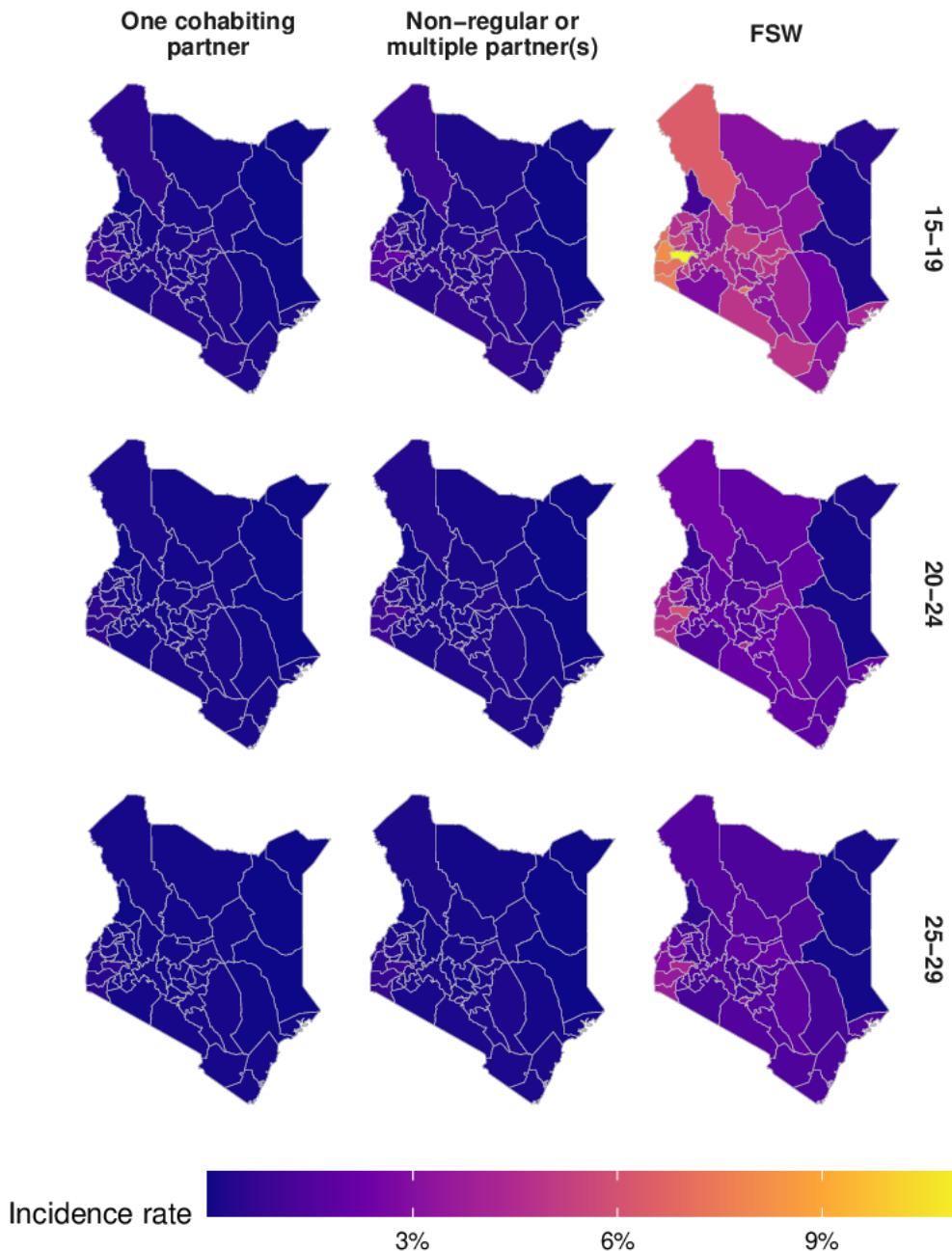


Figure B.33: District-level HIV incidence for each of the risk groups in 2018 in Kenya.

## Lesotho

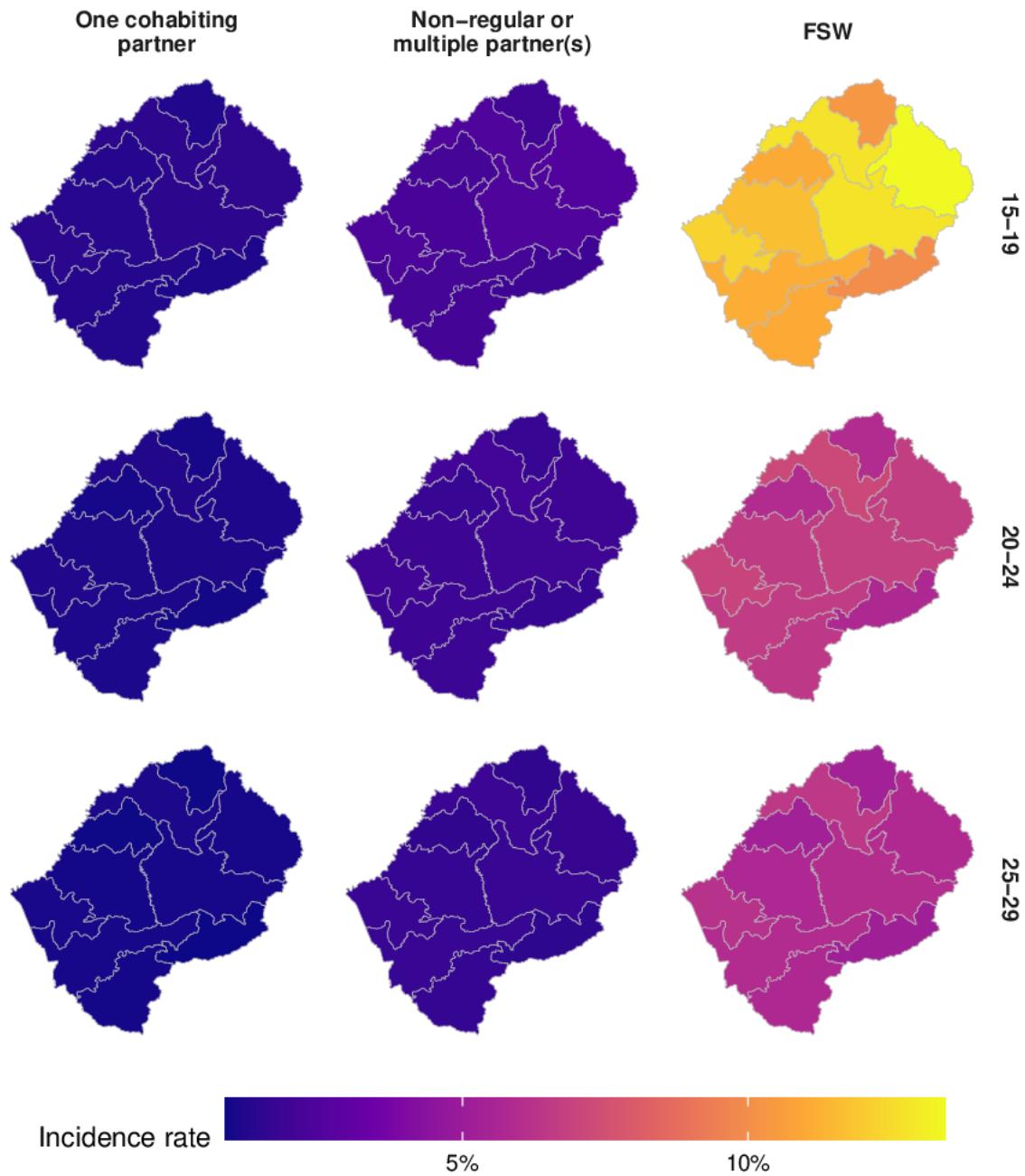


Figure B.34: District-level HIV incidence for each of the risk groups in 2018 in Lesotho.

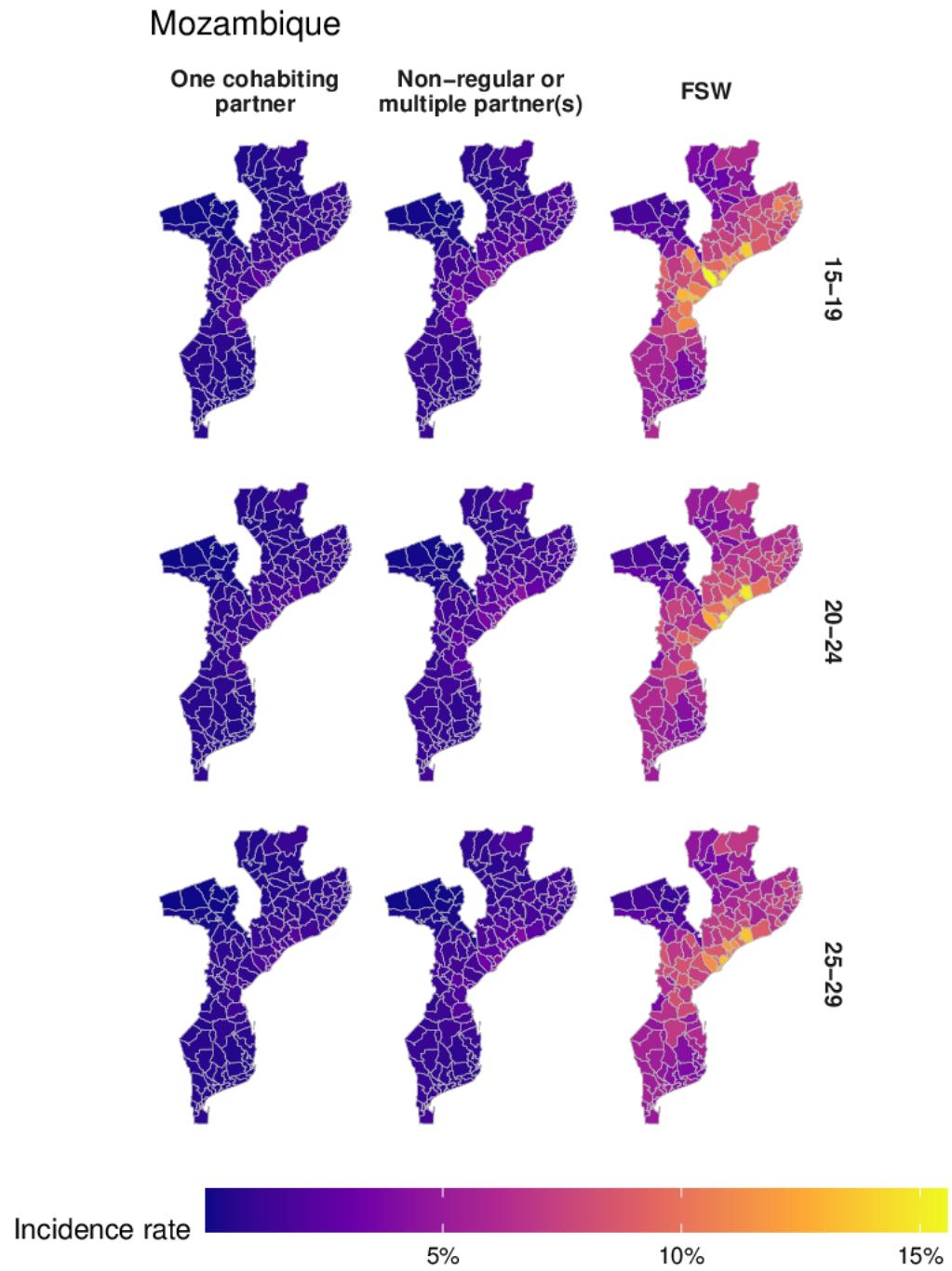


Figure B.35: District-level HIV incidence for each of the risk groups in 2018 in Mozambique.

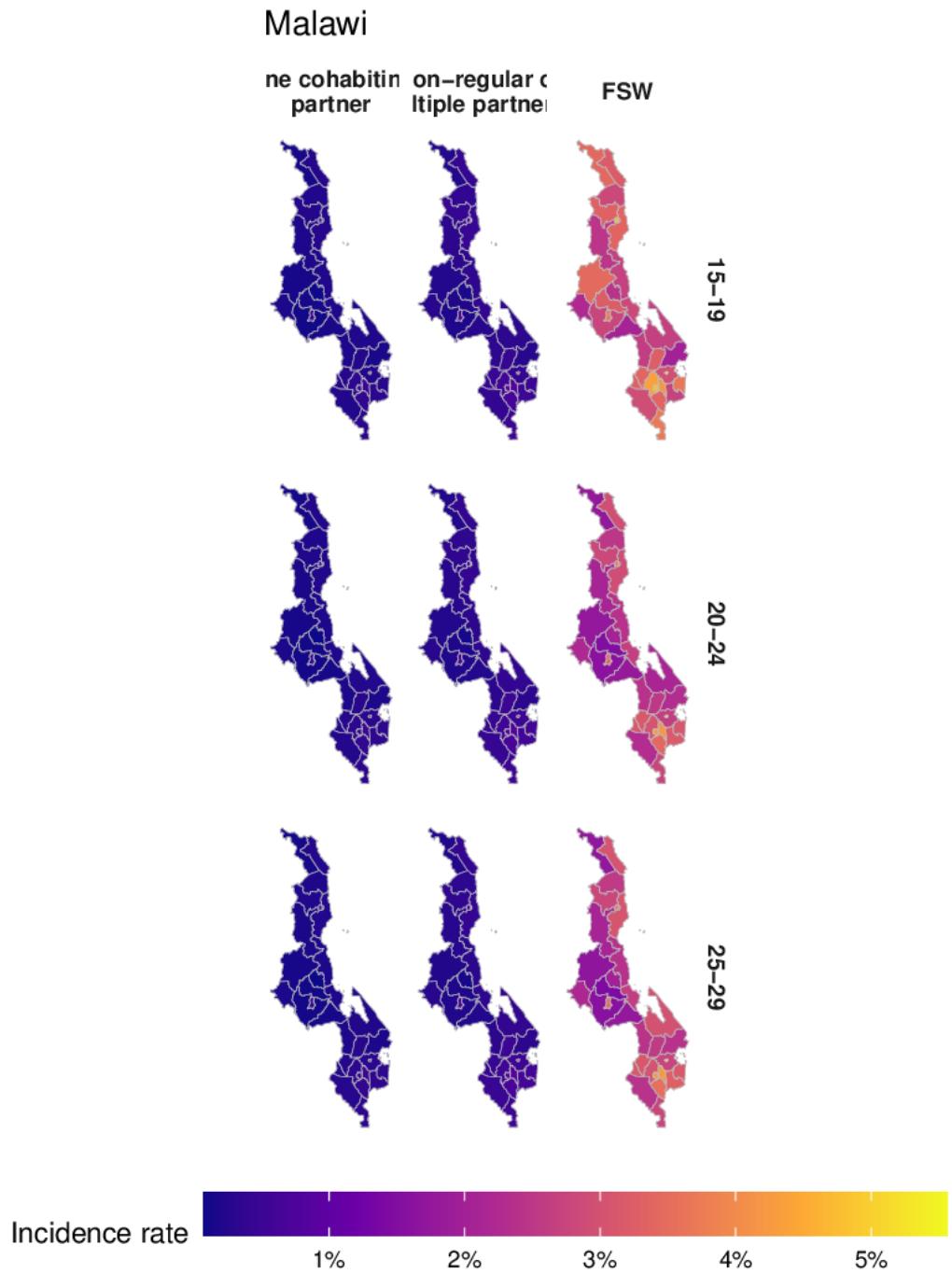


Figure B.36: District-level HIV incidence for each of the risk groups in 2018 in Malawi.

## Namibia

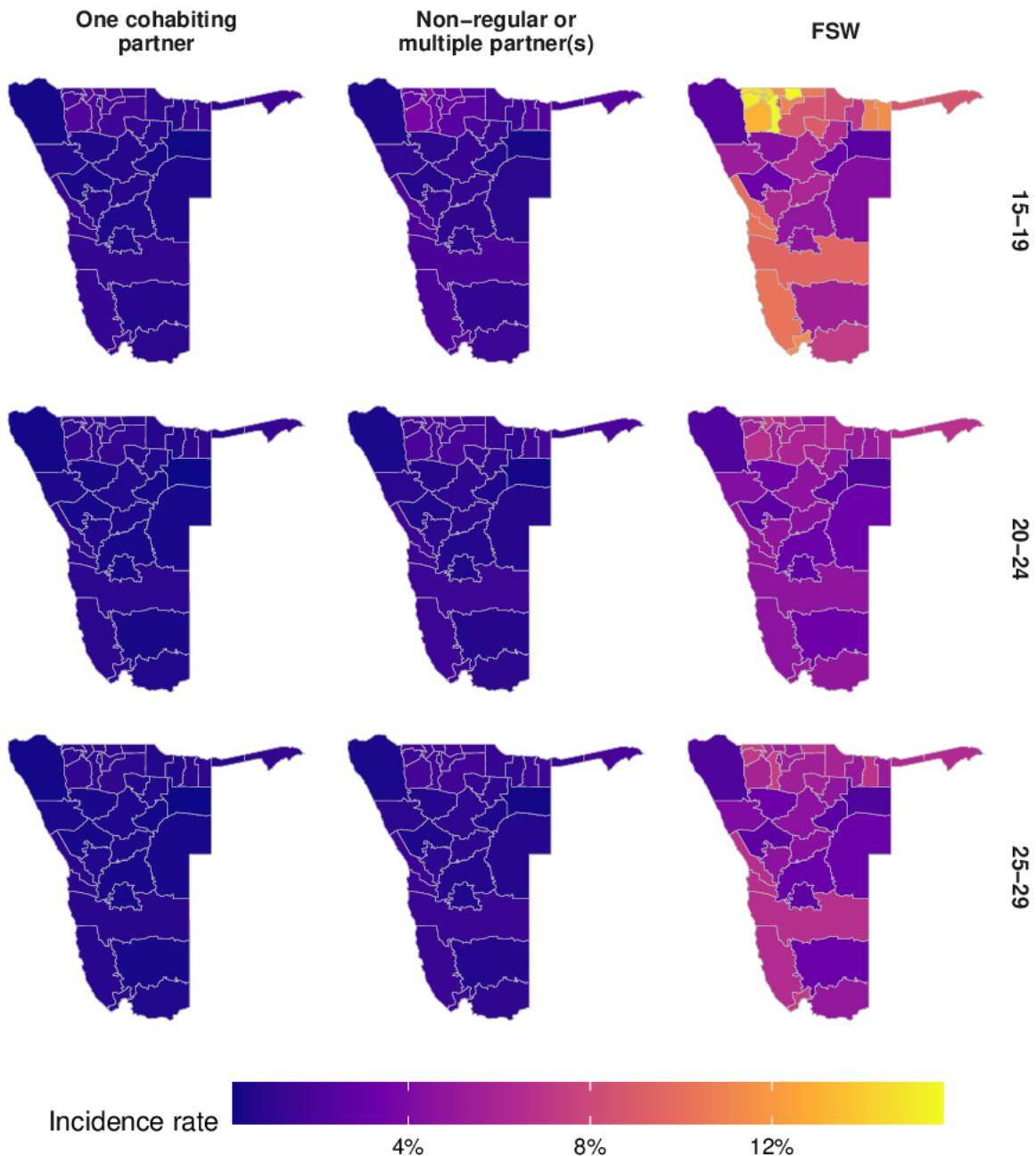


Figure B.37: District-level HIV incidence for each of the risk groups in 2018 in Namibia.

## Eswatini

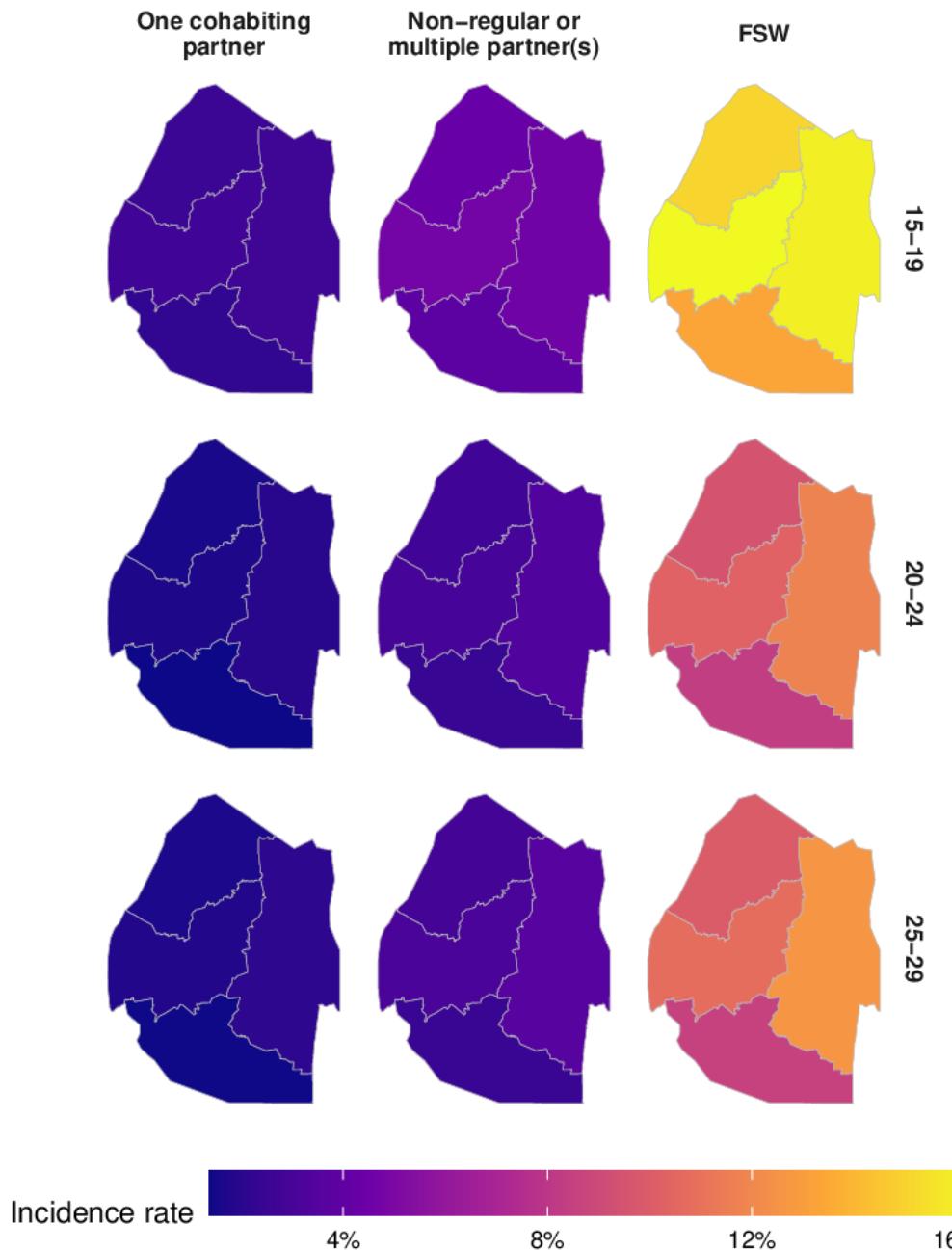


Figure B.38: District-level HIV incidence for each of the risk groups in 2018 in Eswatini.

## Tanzania

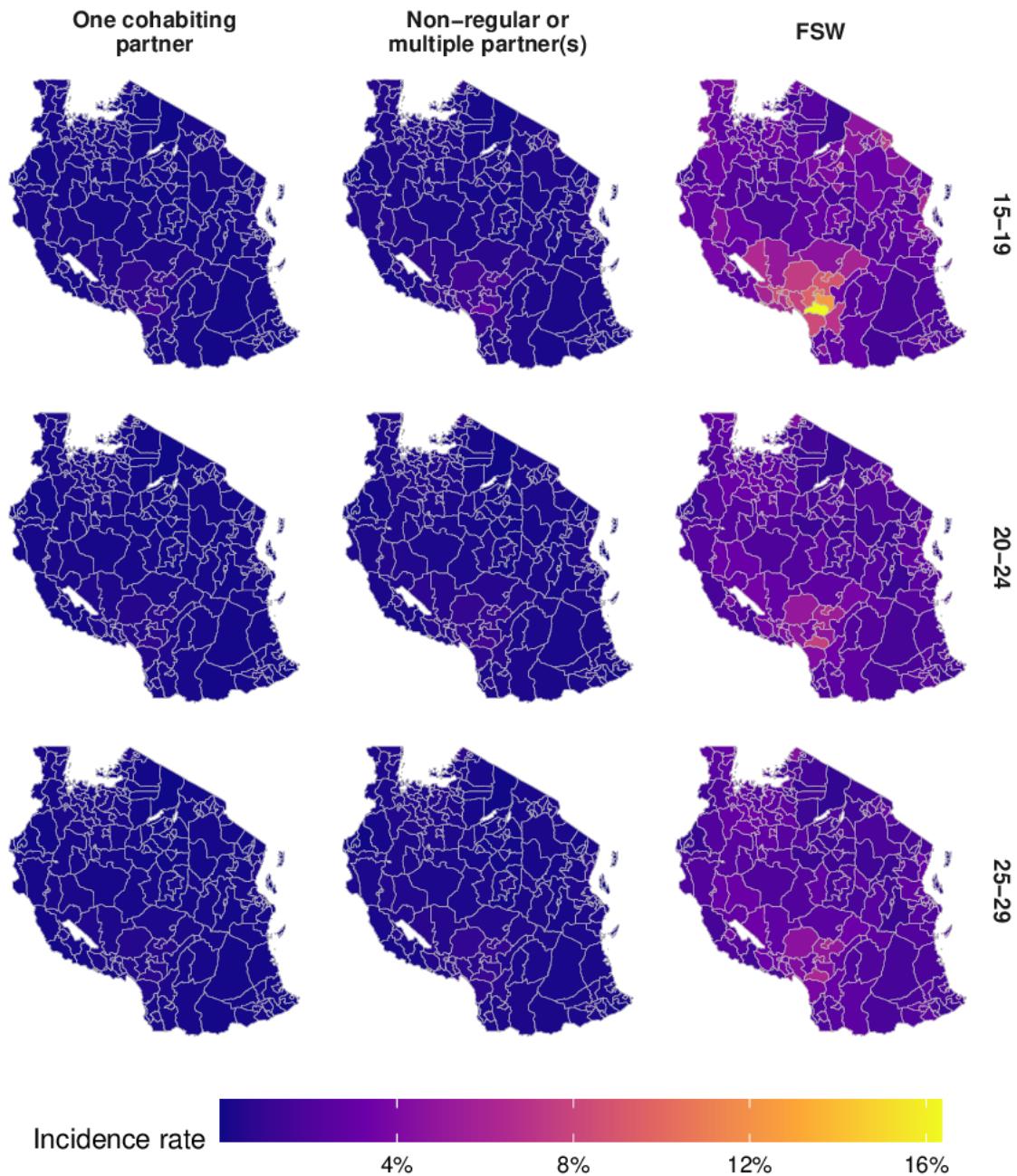


Figure B.39: District-level HIV incidence for each of the risk groups in 2018 in Tanzania.

## Uganda

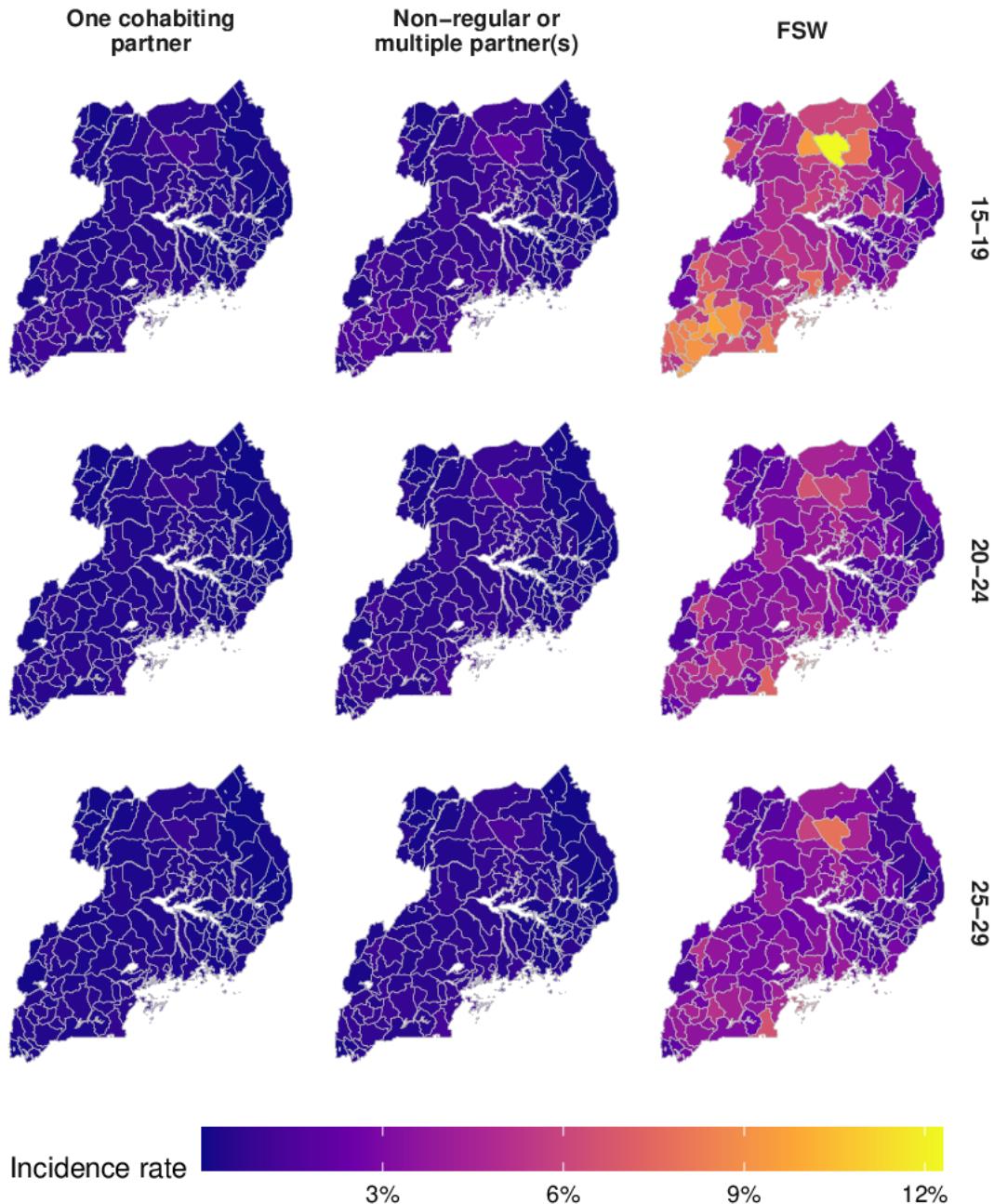


Figure B.40: District-level HIV incidence for each of the risk groups in 2018 in Uganda.

## South Africa

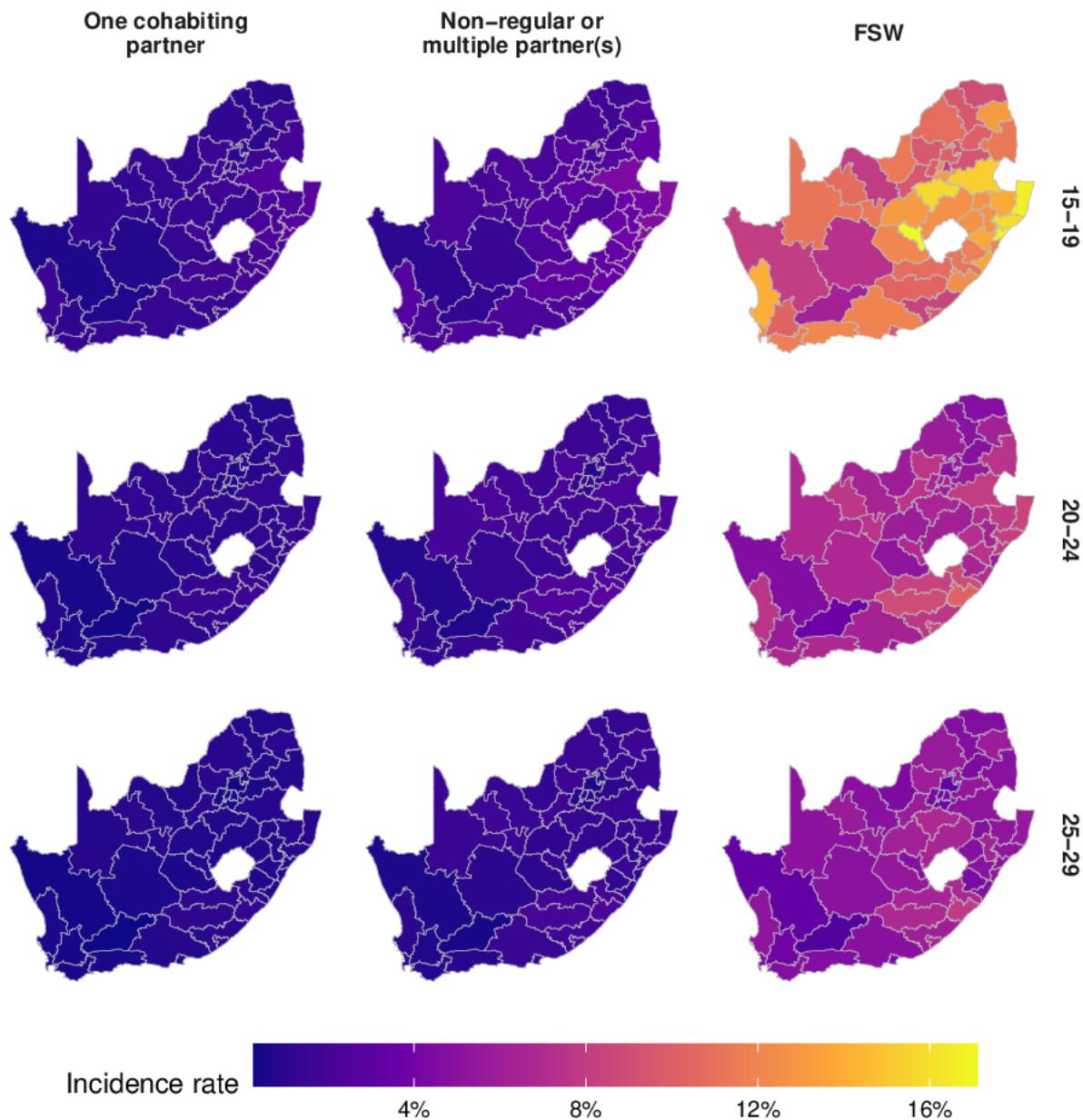


Figure B.41: District-level HIV incidence for each of the risk groups in 2018 in South Africa.

## Zambia

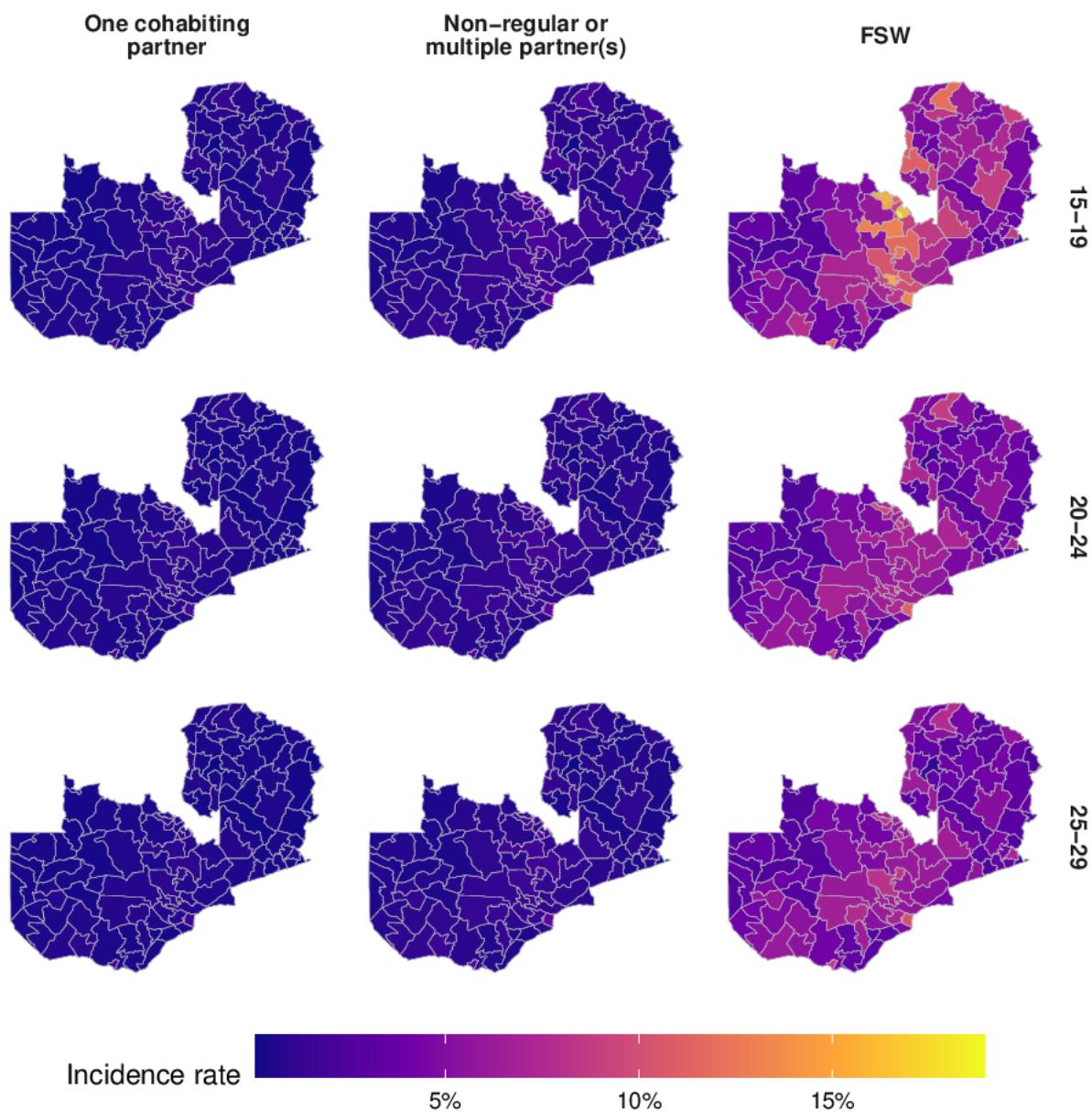


Figure B.42: District-level HIV incidence for each of the risk groups in 2018 in Zambia.

## Zimbabwe

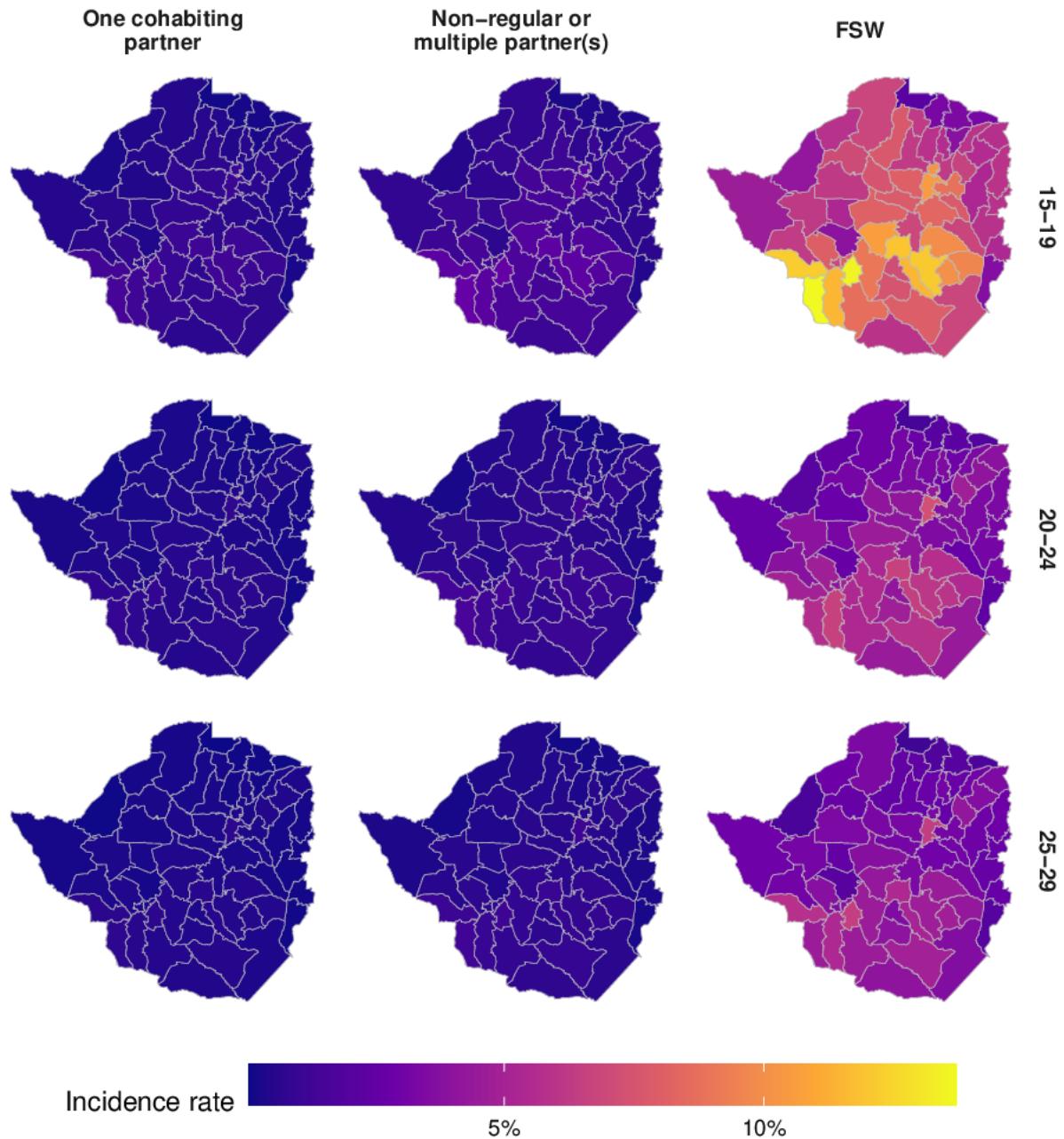


Figure B.43: District-level HIV incidence for each of the risk groups in 2018 in Zimbabwe.

## Expected new infections reached

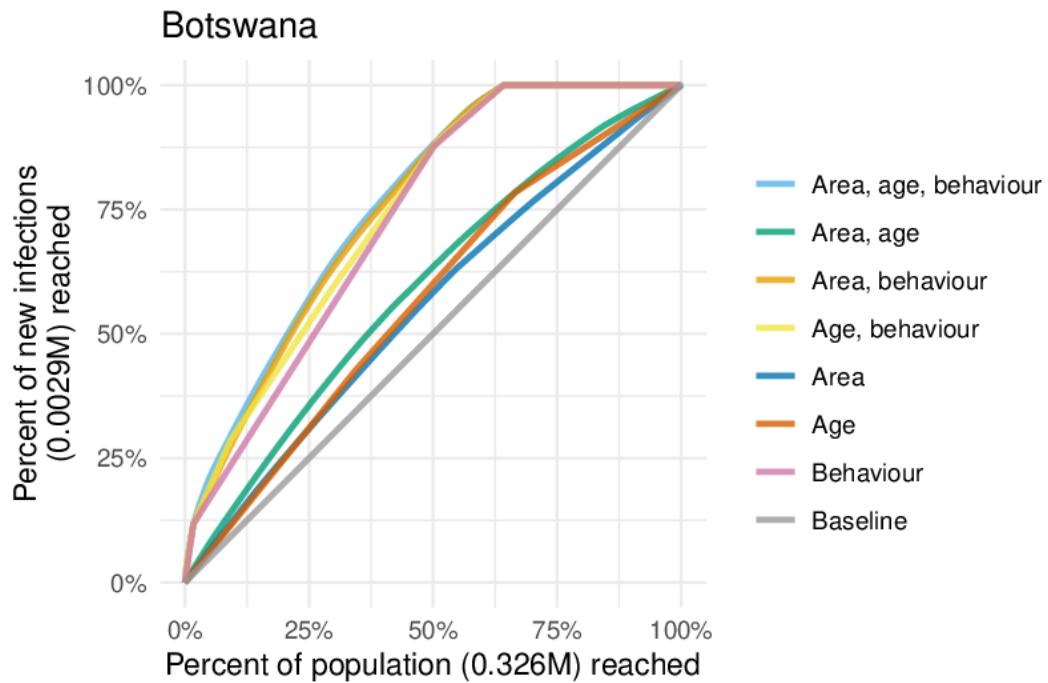


Figure B.44: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Botswana.

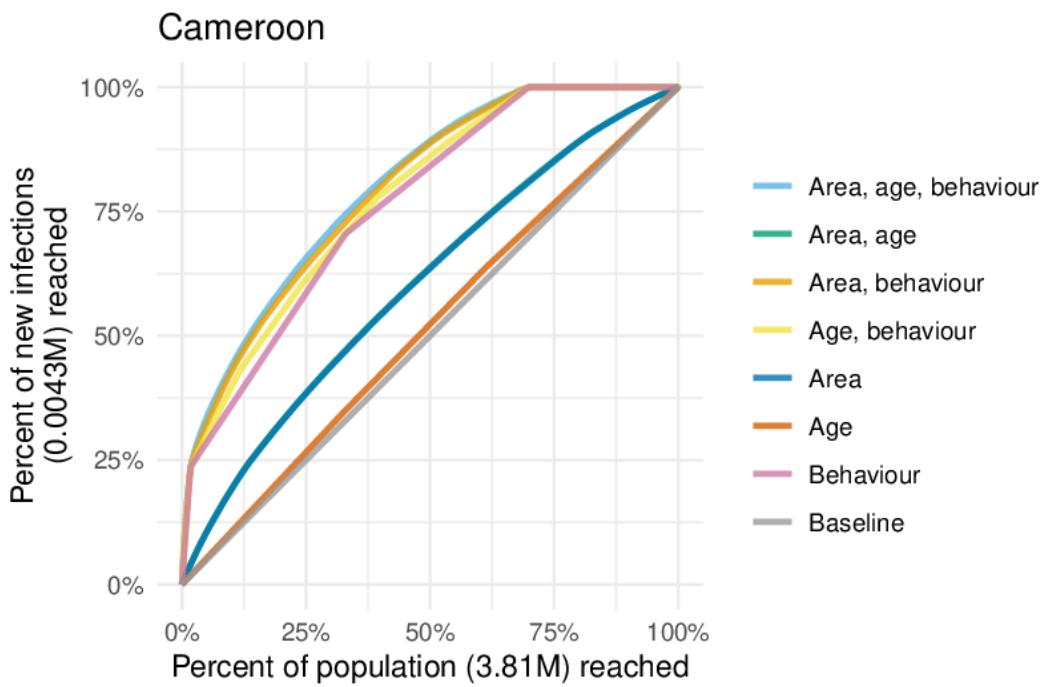


Figure B.45: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Cameroon.

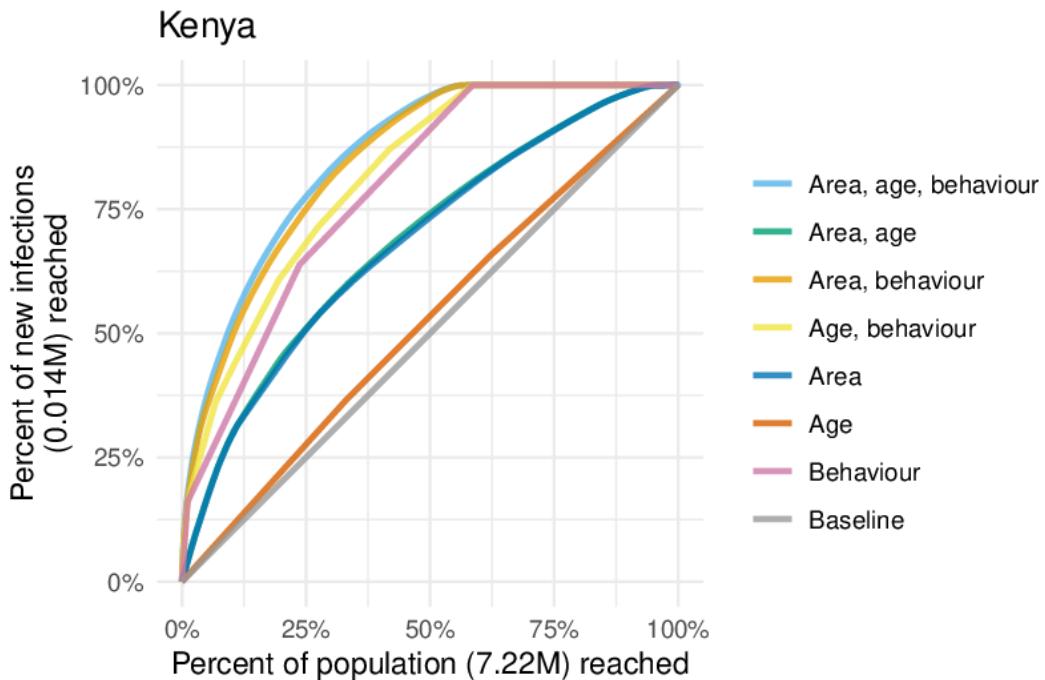


Figure B.46: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Kenya.

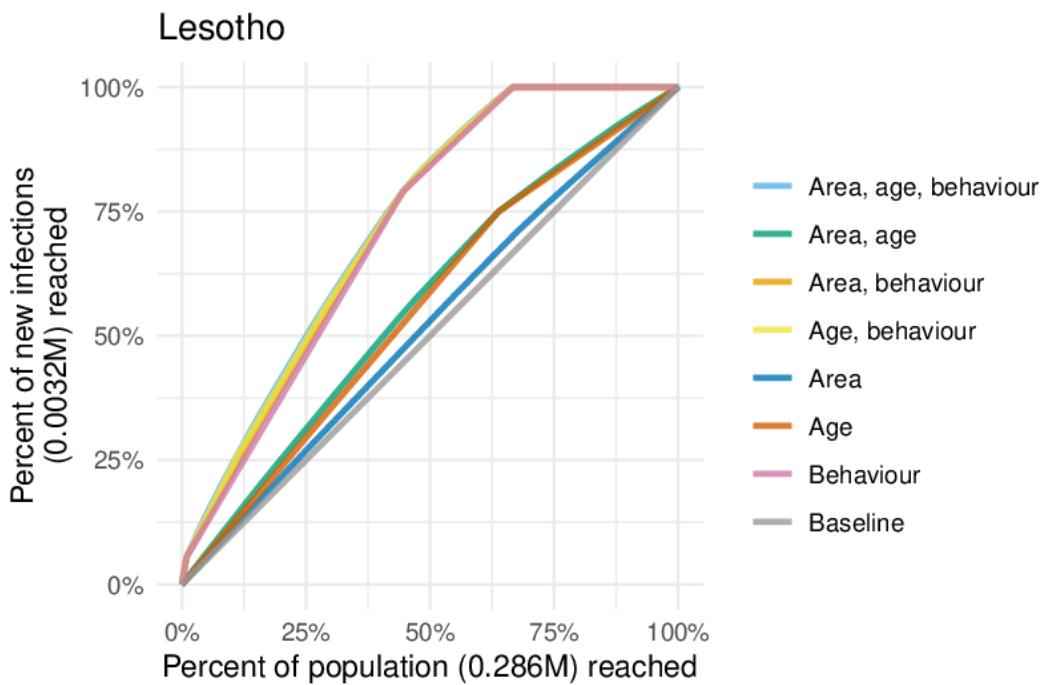


Figure B.47: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Lesotho.

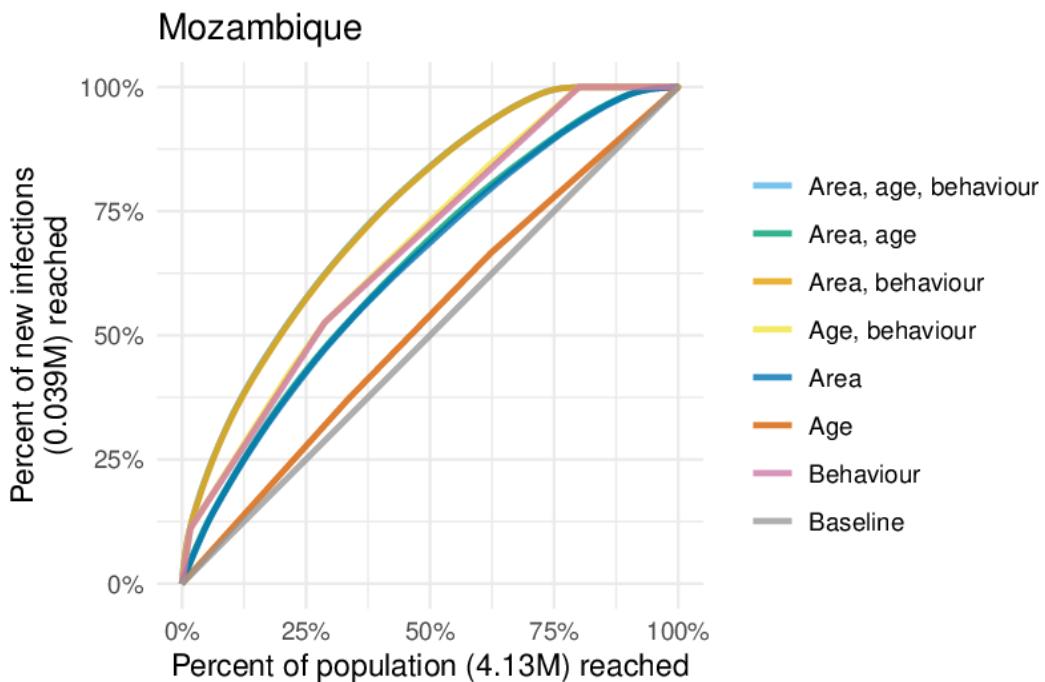


Figure B.48: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Mozambique.

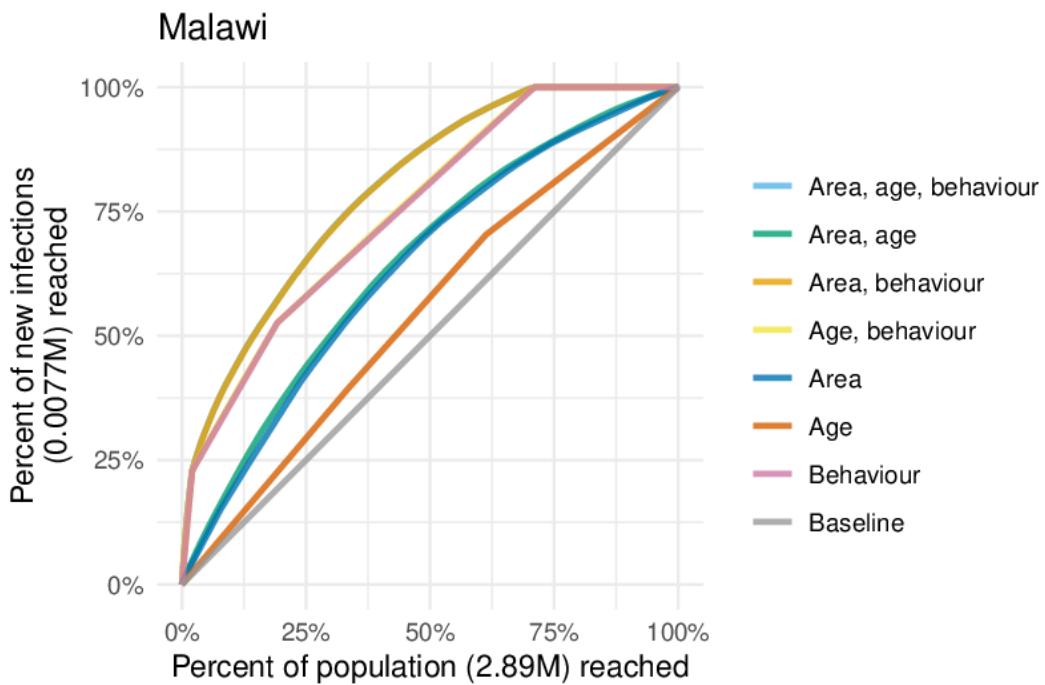


Figure B.49: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Malawi.

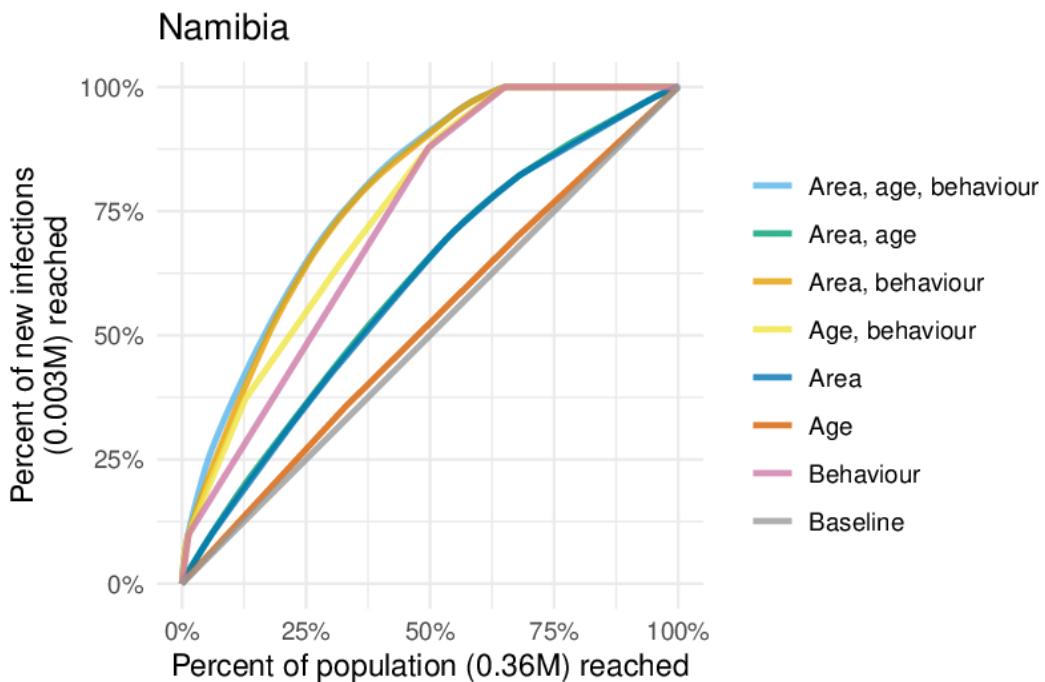


Figure B.50: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Namibia.

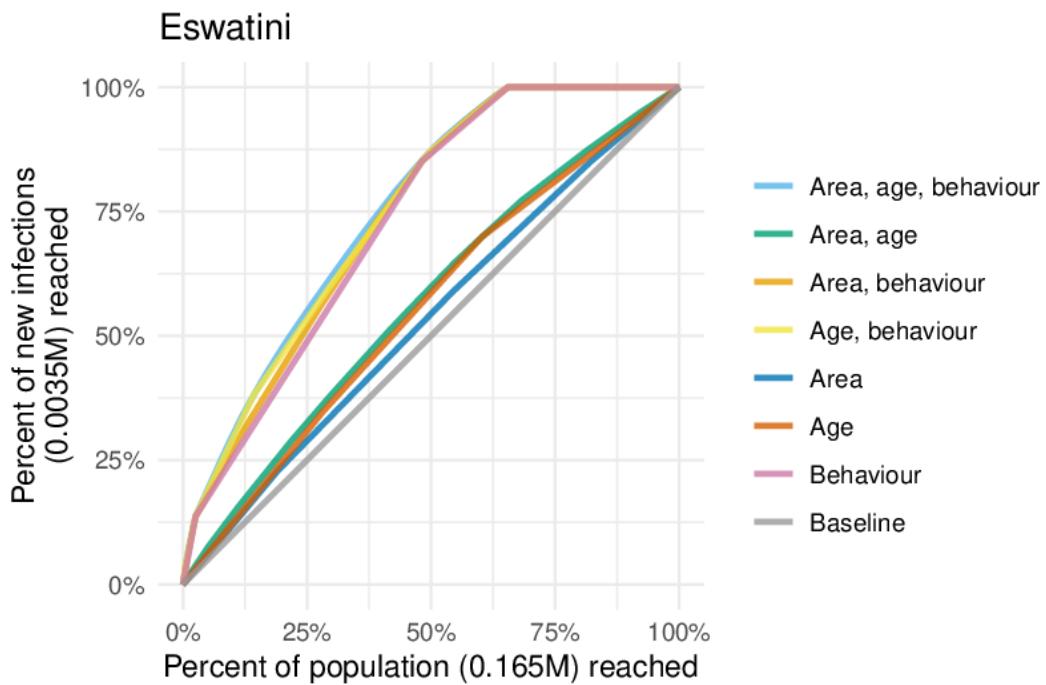


Figure B.51: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Eswatini.

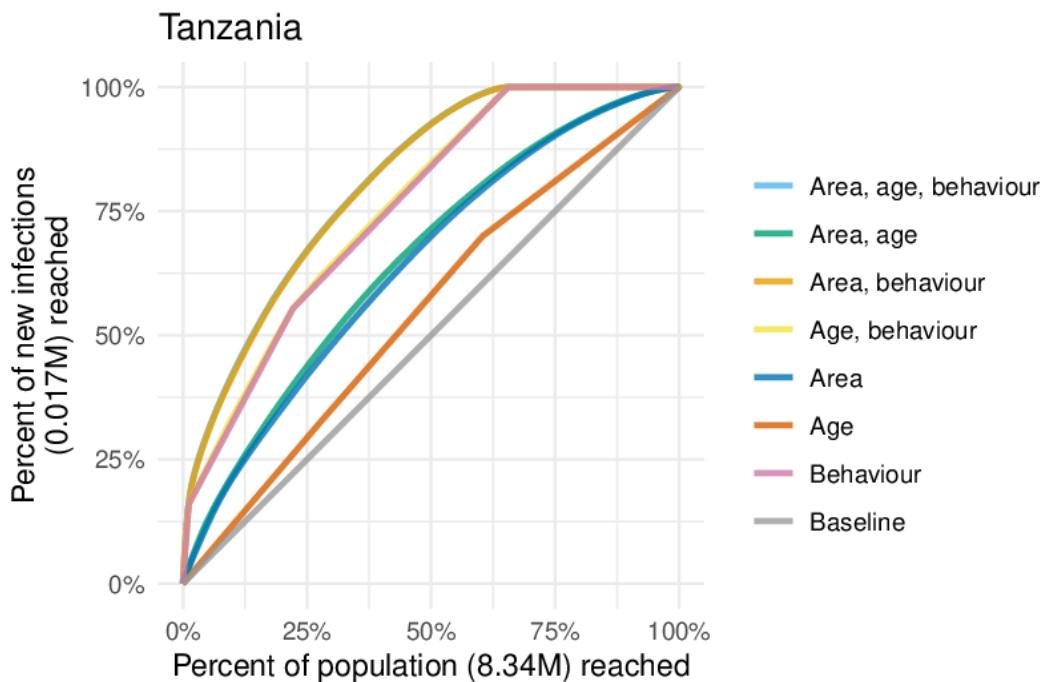


Figure B.52: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Tanzania.

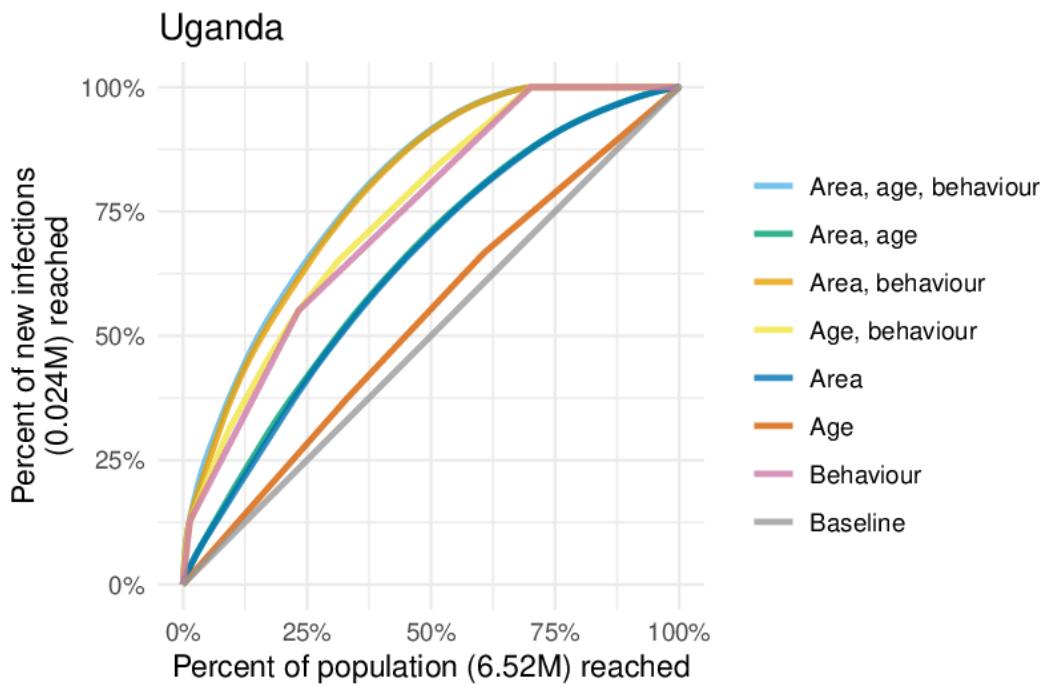


Figure B.53: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Uganda.

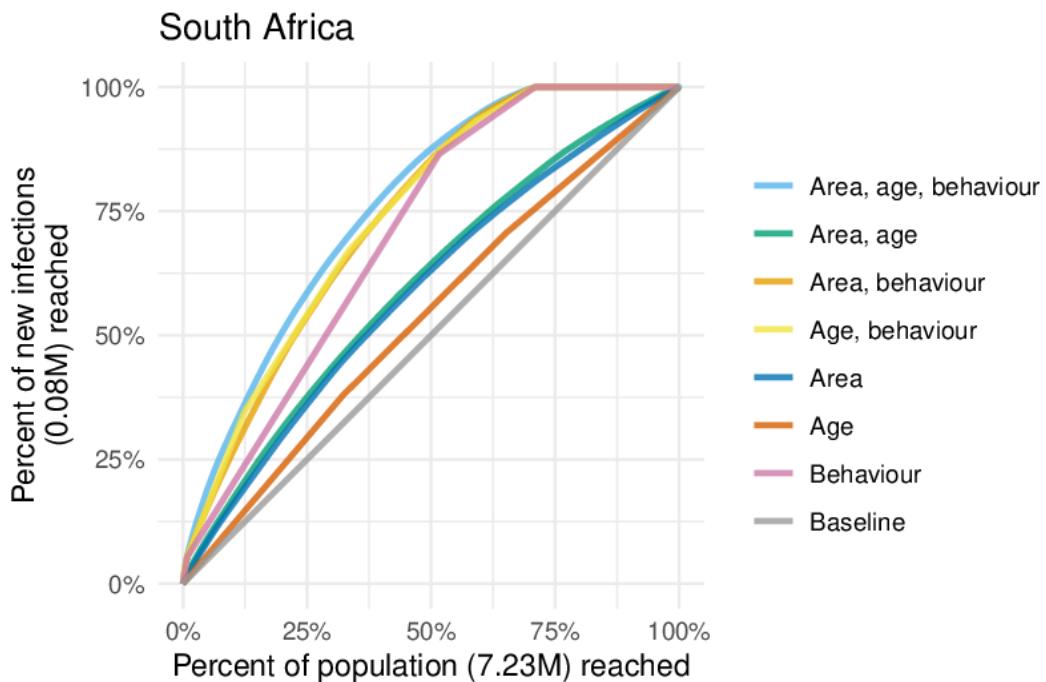


Figure B.54: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in South Africa.

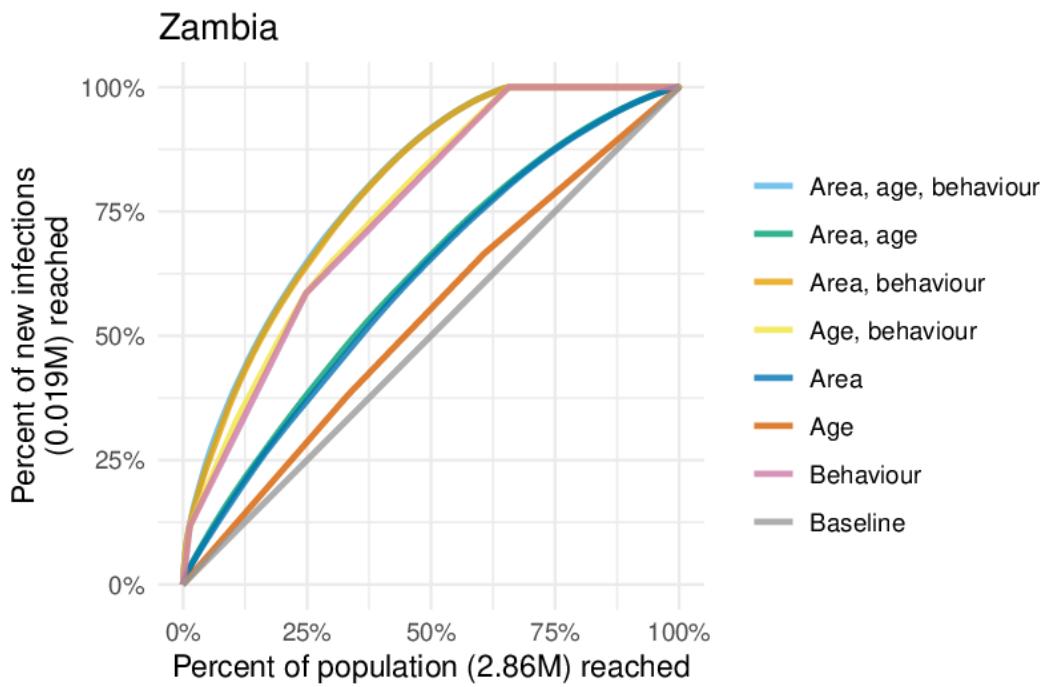


Figure B.55: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Zambia.

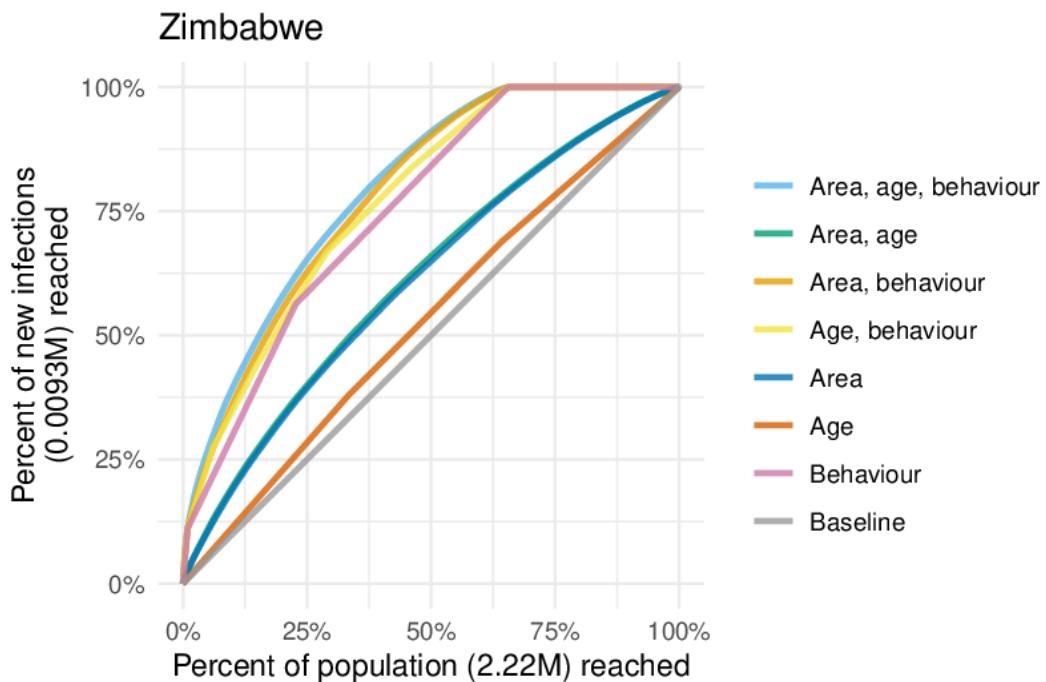


Figure B.56: Percentage of expected new infections reached taking a variety of risk stratification approaches against the percentage of at risk population reached in Zimbabwe.