

# THE LANCET HIV

## Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Wei F, Gaisa MM, D'Souza G, et al. Epidemiology of anal human papillomavirus infection and high-grade squamous intraepithelial lesions in 29 900 men according to HIV status, sexuality, and age: a collaborative pooled analysis of 64 studies. *Lancet HIV* 2021; published online July 30. [http://dx.doi.org/10.1016/S2352-3018\(21\)00108-9](http://dx.doi.org/10.1016/S2352-3018(21)00108-9).

## Supplementary appendix

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## **Search strategy**

### **MEDLINE**

("papillomaviridae"[All Fields] OR "papillomavirus"[All Fields] OR "HPV"[All Fields]) AND (("anal"[All Fields] AND "canal"[All Fields]) OR "anal canal"[All Fields] OR "anus"[All Fields] OR "anal"[All Fields])

### **EMBASE**

('papillomaviridae':ta,ab,kw,ti OR 'papillomavirus':ta,ab,kw,ti OR 'hpv':ta,ab,kw,ti OR 'human papillomavirus':ta,ab,kw,ti) AND ('anal':ta,ab,kw,ti AND 'canal':ta,ab,kw,ti OR 'anal':ta,ab,kw,ti OR 'canal':ta,ab,kw,ti OR 'anus':ta,ab,kw,ti OR 'anal canal':ta,ab,kw,ti) AND ([article]/lim OR [article in press]/lim OR [review]/lim) AND [humans]/lim AND [embase]/lim

### **Cochrane**

("papillomaviridae" or "papillomavirus" or "HPV" or "human papillomavirus") and (("anal" and "canal") or ("anal" or "canal") or "anal" or "anus" or "anal canal")

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## Appendix Tables

**Appendix Table 1: Characteristics of 64 included studies.**

Study	Country	No. of men with anal HPV16 data				No. of men with cytology data	No. of men with current CD4 data	No. of men with nadir CD4 data	No. of men with HIV viral load data	
		Overall	HIV+MSM	HIV-MSM	HIV+MSW					HIV-MSW
<b>North America</b>		<b>9877</b>	<b>5221</b>	<b>3667</b>	<b>38</b>	<b>951</b>	<b>5956</b>	<b>4014</b>	<b>1313</b>	<b>3862</b>
D'Souza et al (2016) <sup>1</sup>	USA	1403	658	723	9	13	✓	✓	✓	✓
Gaisa et al (2021) <sup>2</sup>	USA	1368	1368	0	0	0	✓	✓		✓
Chin-Hong et al (2004) <sup>3*</sup>	USA	1120	0	1120	0	0				
Meites et al (2016) <sup>4†‡</sup>	USA	919	121	798	0	0				
Critchlow et al (1998) <sup>5</sup>	USA	853	451	402	0	0	✓	✓		✓
Sambursky et al (2018) <sup>6</sup>	USA	571	306	250	5	10	✓	✓		✓
Sudenga et al (2017) <sup>7</sup>	USA	540	1	56	0	483				
Wilkin et al (2018) <sup>8</sup>	USA	463	463	0	0	0	✓	✓	✓	✓
Nyitray et al (2008) <sup>9</sup>	USA	440	0	0	1	439				
Choi et al (2021) <sup>10†</sup>	Canada	426	283	143	0	0				
Clarke et al (2018) <sup>11</sup>	USA	341	341	0	0	0	✓			
Hood et al (2016) <sup>12</sup>	USA	335	333	0	2	0	✓	✓		✓
Hernandez et al (2013) <sup>13</sup>	USA	311	311	0	0	0	✓	✓		✓
de Pokomandy et al (2009) <sup>14</sup>	Canada	241	241	0	0	0	✓	✓	✓	✓
Lowe et al (2012) <sup>15</sup>	USA	215	120	95	0	0	✓			
Medina-Laabes et al (2018) <sup>16</sup>	USA	196	149	20	21	6	✓			
Nyitray et al (2017) <sup>17†</sup>	USA	135	75	60	0	0				✓
<b>Asia</b>		<b>8028</b>	<b>2096</b>	<b>3211</b>	<b>242</b>	<b>2479</b>	<b>1308</b>	<b>1147</b>	<b>372</b>	<b>883</b>
Wei et al (2018) <sup>18§</sup>	China	1979	0	0	0	1979				
Tian et al (2017) <sup>19</sup>	China	812	29	783	0	0				
Li et al (2016) <sup>20</sup>	China	786	100	677	1	8				
Gao et al (2010) <sup>21</sup>	China	563	49	499	1	14				
Cheng et al (2015) <sup>22†</sup>	China, Taiwan	558	467	0	91	0	✓	✓		✓
Hu et al (2013) <sup>23</sup>	China	423	170	246	1	6				

Study	Country	No. of men with anal HPV16 data				No. of men with cytology data	No. of men with current CD4 data	No. of men with nadir CD4 data	No. of men with HIV viral load data	
		Overall	HIV+MSM	HIV-MSM	HIV+MSW					HIV-MSW
Cranston et al (2015) <sup>24</sup>	Thailand	386	192	191	0	3		✓	✓	
Khoo et al (2021) <sup>25† §</sup>	Malaysia	349	0	25	0	324				
Wang et al (2019) <sup>26†</sup>	China, Taiwan	319	103	134	8	74	✓			
Hernandez et al (2016) <sup>27</sup>	India	266	266	0	0	0		✓	✓	
Liu et al (2019) <sup>28</sup>	China	257	80	69	72	36		✓		
Strong et al (2020) <sup>29</sup>	China, Taiwan	249	10	239	0	0				
Phanuphak et al (2013) <sup>30</sup>	Thailand	243	120	123	0	0	✓	✓	✓	
Yuniastuti et al (2020) <sup>31</sup>	Indonesia, Malaysia, Thailand	236	143	93	0	0		✓	✓	
Li et al (2015) <sup>32</sup>	China	191	191	0	0	0				
Ruanpeng et al (2016) <sup>33‡</sup>	Thailand	168	48	120	0	0	✓			
Wittawatmongkol et al (2019) <sup>34</sup>	Thailand	95	5	12	43	35		✓	✓	
Yang et al (2012) <sup>35</sup>	China	87	87	0	0	0				
Leng et al (2017) <sup>36</sup>	Malaysia	61	36	0	25	0	✓	✓		
<b>Europe</b>		<b>7524</b>	<b>4868</b>	<b>1815</b>	<b>64</b>	<b>777</b>	<b>4548</b>	<b>4059</b>	<b>3296</b>	<b>3985</b>
van Aar et al (2013) <sup>37</sup>	Netherlands	1044	331	713	0	0		✓	✓	✓
Dona et al (2014) <sup>38</sup>	Italy	881	359	522	0	0	✓	✓	✓	✓
Viciana et al (2019) <sup>39</sup>	Spain	641	610	0	31	0	✓	✓	✓	✓
Torres et al (2013) <sup>40*</sup>	Spain	568	568	0	0	0				
Combes et al (2018) <sup>41</sup>	France	513	513	0	0	0	✓	✓	✓	✓
Fuchs et al (2016) <sup>42</sup>	Germany	485	485	0	0	0	✓	✓		✓
Smelov et al (2018) <sup>43</sup>	Russia	484	0	23	1	460				
Burgos et al (2015) <sup>44</sup>	Spain	473	473	0	0	0	✓	✓	✓	✓
Iribarren Diaz et al (2017) <sup>45</sup>	Spain	431	364	34	20	13	✓	✓	✓	✓
Woostenberg et al (2020) <sup>46†</sup>	Netherlands	415	18	397	0	0				
Hidalgo-Tenorio et al (2019) <sup>47</sup>	Spain	393	393	0	0	0	✓	✓	✓	✓
Schofield et al (2016) <sup>48</sup>	UK	283	202	81	0	0	✓	✓		✓

Study	Country	No. of men with anal HPV16 data				No. of men with cytology data	No. of men with current CD4 data	No. of men with nadir CD4 data	No. of men with HIV viral load data	
		Overall	HIV+MSM	HIV-MSM	HIV+MSW					HIV-MSW
Tsikis et al (2018) <sup>49</sup>	Greece	272	47	37	11	177				
Pernot et al (2018) <sup>50</sup>	France	227	227	0	0	0	✓	✓	✓	
Del Pino et al (2019) <sup>51</sup>	Spain	198	198	0	0	0	✓	✓	✓	
Etiennay et al (2012) <sup>52</sup>	France	142	6	8	1	127	✓			
Damay et al (2010) <sup>53</sup>	France	74	74	0	0	0	✓	✓	✓	
<b>Latin America</b>		<b>1663</b>	<b>389</b>	<b>272</b>	<b>22</b>	<b>980</b>	<b>376</b>	<b>283</b>	<b>7</b>	<b>296</b>
Sudenga et al (2017) <sup>7</sup>	Brazil, Mexico	1258	6	272	0	980				
Posada et al (2020) <sup>54</sup>	Colombia	397	375	0	22	0	✓	✓	✓	
Wilkin et al (2018) <sup>8</sup>	Brazil	8	8	0	0	0	✓	✓	✓	
<b>Oceania</b>		<b>1547</b>	<b>470</b>	<b>1073</b>	<b>1</b>	<b>3</b>	<b>580</b>	<b>421</b>	<b>376</b>	<b>426</b>
Machalek et al (2016) <sup>55</sup>	Australia	608	214	390	1	3	✓	✓	✓	
Chow et al (2019) <sup>56</sup>	Australia	496	12	484	0	0		✓	✓	
Ong et al (2019) <sup>57</sup>	Australia	244	244	0	0	0		✓	✓	
Zou et al (2014) <sup>58</sup>	Australia	199	0	199	0	0				
<b>Africa</b>		<b>1261</b>	<b>367</b>	<b>579</b>	<b>315</b>	<b>0</b>	<b>485</b>	<b>536</b>	<b>225</b>	<b>449</b>
Nowak et al (2020) <sup>59</sup>	Nigeria	342	204	138	0	0	✓	✓	✓	
Murenzi et al (2020) <sup>60</sup>	Rwanda	342	67	275	0	0				
Chikandiwa et al (2017) <sup>61</sup>	South Africa	280	12	0	268	0	✓	✓	✓	
Ferre et al (2019) <sup>62</sup>	Togo	207	54	153	0	0				
Chinyowa et al (2018) <sup>63</sup>	Zimbabwe	48	1	0	47	0		✓	✓	
Mboumba Bouassa et al (2018) <sup>64</sup>	Central African Republic	42	29	13	0	0		✓		
<b>Total</b>		<b>29 900</b>	<b>13 411</b>	<b>10 617</b>	<b>682</b>	<b>5190</b>	<b>13 253</b>	<b>10 460</b>	<b>5589</b>	<b>9901</b>

HIV+=HIV-positive. HIV-=HIV-negative. MSM=men who have sex with men. MSW=men who have sex with women. Ticks (✓) indicate these studies collected and shared the corresponding data with us. \*Relative data were extracted from the original papers by age group. †All or part of men in these studies self-collected anal samples. ‡These studies enrolled a fraction of transgender women. §These studies were deemed to be the population-based studies for which men were assumed to be HIV-negative, even in the absence of such information at an individual level.

**Appendix Table 2: Prevalence of anal HSIL+ in studies that performed HRA in all participants and enrolled both HIV-positive and HIV-negative MSM.**

	Anal HSIL+ in all MSM (N=2004)		HPV16-positive anal HSIL+* in all MSM (N=2004)		Anal HSIL+ in HPV16-positive MSM (N=460)	
	n/N (%)	aPR (95% CI)	n/N (%)	aPR (95% CI)	n/N (%)	aPR (95% CI)
<b>Age group, years</b>						
15–24	32/214 (15.0%)	1.19 (0.84–1.69)	10/214 (4.7%)	1.20 (0.58–2.47)	10/47 (21.3%)	1.30 (0.73–2.29)
25–34	67/377 (17.8%)	Ref.	21/377 (5.6%)	Ref.	21/77 (27.3%)	Ref.
35–44	157/443 (35.4%)	1.15 (0.89–1.48)	71/443 (16.0%)	1.46 (0.89–2.42)	71/120 (59.2%)	1.35 (0.90–2.03)
45–54	172/495 (34.7%)	1.04 (0.81–1.34)	82/495 (16.6%)	1.45 (0.87–2.39)	82/129 (63.6%)	1.38 (0.92–2.08)
≥55	134/475 (28.2%)	1.03 (0.78–1.34)	59/475 (12.4%)	1.40 (0.83–2.38)	59/87 (67.8%)	1.53 (0.99–2.34)
<b>Age, per 10 years</b>		0.97 (0.91–1.03)		1.00 (0.90–1.12)		1.06 (0.99–1.15)
<b>HIV status</b>						
Negative	233/960 (24.3%)	Ref.	104/960 (10.8%)	Ref.	104/193 (53.9%)	Ref.
Positive	329/1044 (31.5%)	1.44 (1.25–1.65) <sup>†</sup>	139/1044 (13.3%)	1.41 (1.11–1.80) <sup>†</sup>	139/267 (52.1%)	1.14 (0.97–1.34)

PRs were adjusted for study, age group, and HIV status, as appropriate. HSIL+=high-grade squamous intraepithelial lesions and worse. HPV=human papillomavirus. MSM=men who have sex with men. aPR=adjusted prevalence ratio. \*Only includes participants with HSIL+ plus HPV16-positive swabs. <sup>†</sup>Significant aPRs relative to the reference group.



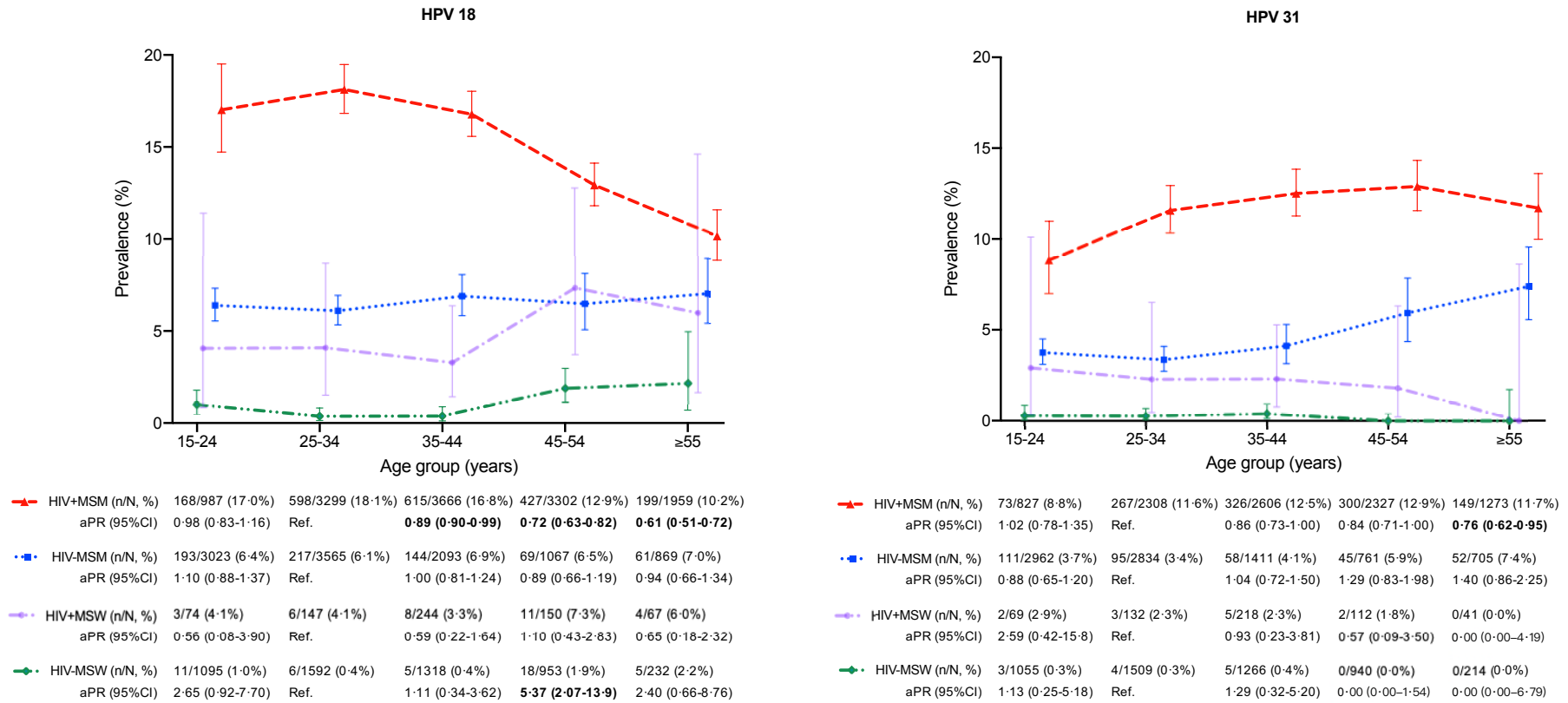
**Appendix Table 3: Prevalence of anal histological HSIL+ in studies that performed HRA in all participants and enrolled both HIV-positive and HIV-negative MSM.**

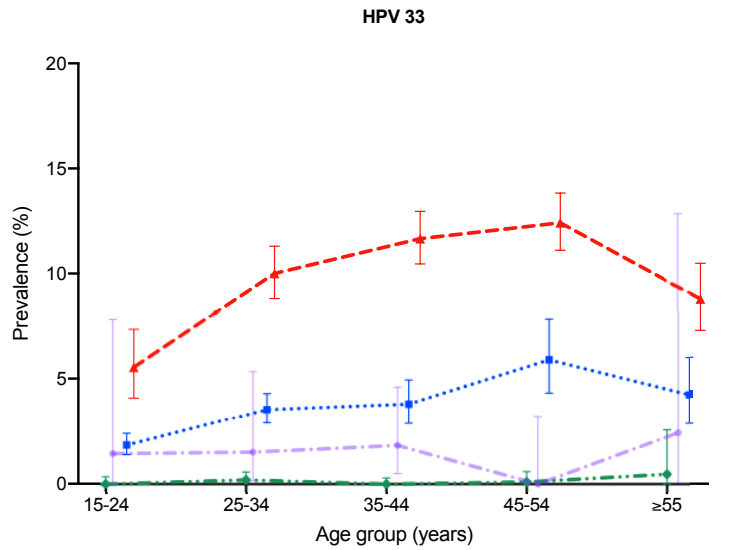
	Anal HSIL+ in all MSM (N=2004)		HPV16-positive anal HSIL+* in all MSM (N=2004)		Anal HSIL+ in HPV16-positive MSM (N=460)	
	n/N (%)	aPR (95% CI)	n/N (%)	aPR (95% CI)	n/N (%)	aPR (95% CI)
<b>Age group, years</b>						
15–24	30/214 (14.0%)	1.17 (0.82–1.67)	8/214 (3.7%)	1.01 (0.46–2.22)	8/47 (17.0%)	1.17 (0.61–2.24)
25–34	67/377 (17.8%)	Ref.	21/377 (5.6%)	Ref.	21/77 (27.3%)	Ref.
35–44	122/443 (27.5%)	1.03 (0.80–1.34)	60/443 (13.5%)	1.37 (0.82–2.28)	60/120 (50.0%)	1.27 (0.86–1.87)
45–54	142/495 (28.7%)	0.97 (0.75–1.26)	67/495 (13.5%)	1.30 (0.78–2.16)	67/129 (51.9%)	1.27 (0.85–1.91)
≥55	114/475 (24.0%)	0.98 (0.74–1.29)	53/475 (11.2%)	1.40 (0.81–2.38)	53/87 (60.9%)	1.54 (1.01–2.34)†
<b>Age, per 10 years</b>		0.98 (0.91–1.05)		1.03 (0.92–1.16)		1.11 (1.01–1.22)†
<b>HIV status</b>						
Negative	170/960 (17.7%)	Ref.	81/960 (8.4%)	Ref.	81/193 (42.0%)	Ref.
Positive	305/1044 (29.2%)	1.75 (1.48–2.06)†	128/1044 (12.3%)	1.59 (1.22–2.09)†	128/267 (47.9%)	1.26 (1.02–1.55)†

PRs were adjusted for study, age group, and HIV status, as appropriate. HSIL+=high-grade squamous intraepithelial lesions and worse. HPV=human papillomavirus. MSM=men who have sex with men. aPR=adjusted prevalence ratio. \*Only includes participants with HSIL+ plus HPV16-positive swabs. †Significant aPRs relative to the reference group.

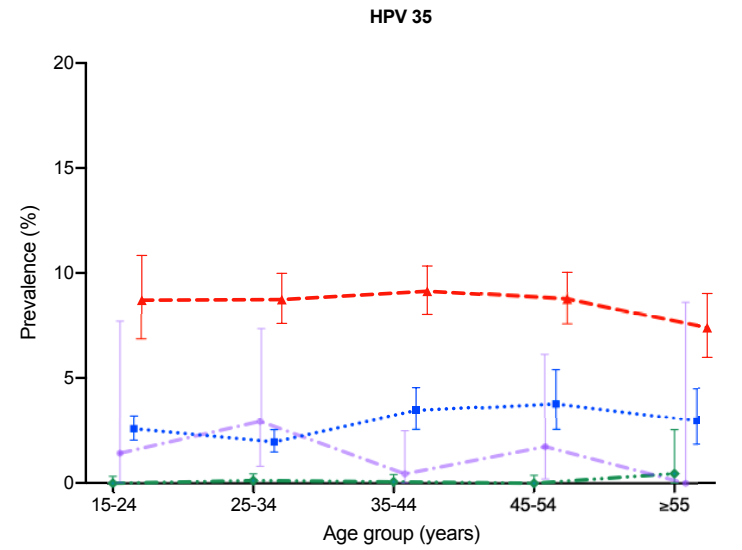
## Appendix Figures

**Appendix Figure 1: Age-specific prevalence of individual non-16 HR-HPV infection in four male risk groups.** Error bars show 95% CIs. PRs were adjusted for study. HPV=human papillomavirus. HIV+=HIV positive. HIV-=HIV negative. MSM=men who have sex with men. MSW=men who have sex with women. aPR=adjusted prevalence ratio. Significant aPRs relative to the reference group are shown in bold.



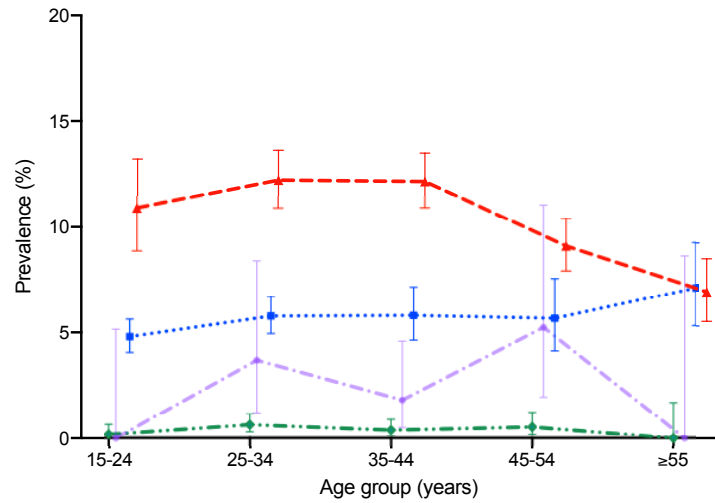


<span style="color: red;">—▲</span> HIV+MSM (n/N, %)	46/827 (5.6%)	231/2308 (10.0%)	304/2606 (11.7%)	289/2327 (12.4%)	112/1273 (8.8%)
aPR (95%CI)	<b>0.64 (0.46-0.89)</b>	Ref.	1.01 (0.85-1.20)	1.06 (0.88-1.28)	0.80 (0.63-1.02)
<span style="color: blue;">-■-</span> HIV+MSM (n/N, %)	55/2962 (1.9%)	101/2834 (3.6%)	54/1411 (3.8%)	45/761 (5.9%)	30/705 (4.3%)
aPR (95%CI)	<b>0.53 (0.37-0.76)</b>	Ref.	0.90 (0.63-1.29)	1.33 (0.88-2.02)	1.03 (0.60-1.75)
<span style="color: purple;">-◆-</span> HIV+MSW (n/N, %)	1/69 (1.4%)	2/132 (1.5%)	4/218 (1.8%)	0/112 (0.0%)	1/41 (2.4%)
aPR (95%CI)	0.96 (0.02-18.7)	Ref.	<b>0.89 (0.16-5.03)</b>	0.00 (0.00-2.26)	0.39 (0.02-6.04)
<span style="color: green;">-◆-</span> HIV+MSW (n/N, %)	0/1055 (0.0%)	3/1509 (0.2%)	0/1266 (0.0%)	1/940 (0.1%)	1/214 (0.5%)
aPR (95%CI)	0.00 (0.00-1.83)	Ref.	0.00 (0.00-1.53)	<b>0.63 (0.06-6.93)</b>	1.34 (0.09-19.5)



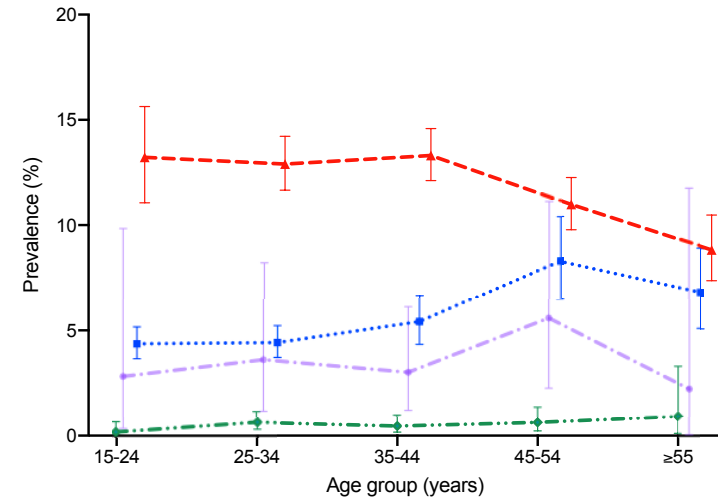
<span style="color: red;">—▲</span> HIV+MSM (n/N, %)	72/827 (8.7%)	197/2254 (8.7%)	228/2496 (9.1%)	187/2137 (8.8%)	89/1203 (7.4%)
aPR (95%CI)	0.88 (0.67-1.17)	Ref.	1.06 (0.87-1.28)	0.93 (0.74-1.16)	<b>0.71 (0.53-0.94)</b>
<span style="color: blue;">-■-</span> HIV+MSM (n/N, %)	77/2972 (2.6%)	56/2852 (2.0%)	49/1419 (3.5%)	29/762 (3.8%)	21/705 (3.0%)
aPR (95%CI)	1.08 (0.75-1.57)	Ref.	1.36 (0.87-2.13)	1.12 (0.64-1.97)	0.82 (0.42-1.60)
<span style="color: purple;">-◆-</span> HIV+MSW (n/N, %)	1/70 (1.4%)	4/136 (2.9%)	1/221 (0.5%)	2/115 (1.7%)	0/41 (0.0%)
aPR (95%CI)	1.16 (0.13-10.6)	Ref.	0.14 (0.02-1.26)	<b>0.67 (0.12-3.80)</b>	0.00 (0.00-3.19)
<span style="color: green;">-◆-</span> HIV+MSW (n/N, %)	0/1094 (0.0%)	2/1585 (0.1%)	1/1315 (0.1%)	0/950 (0.0%)	1/217 (0.5%)
aPR (95%CI)	0.00 (0.00-2.78)	Ref.	0.70 (0.06-8.18)	0.00 (0.00-3.21)	<b>4.36 (0.39-49.4)</b>

HPV 39

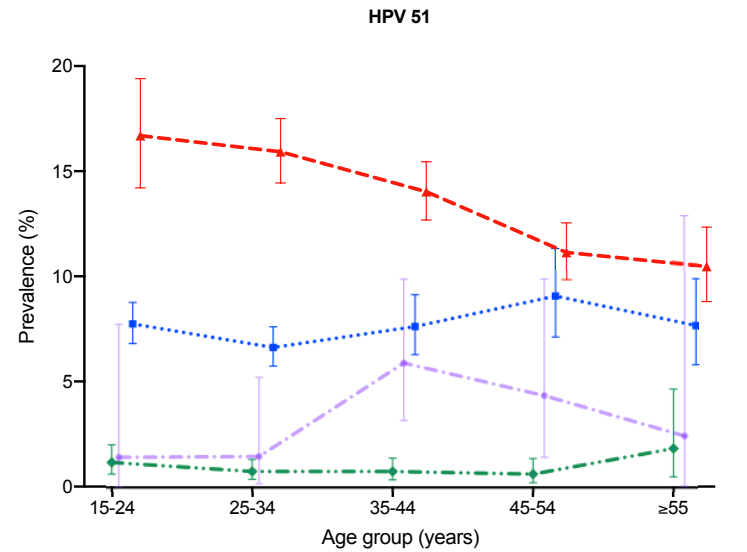


Category	15-24	25-34	35-44	45-54	≥55
HIV+MSM (n/N, %)	90/827 (10.9%)	275/2254 (12.2%)	303/2496 (12.1%)	194/2137 (9.1%)	83/1203 (6.9%)
aPR (95%CI)	0.88 (0.69-1.12)	Ref.	1.03 (0.88-1.21)	<b>0.80 (0.65-0.98)</b>	<b>0.57 (0.43-0.75)</b>
HIV+MSM (n/N, %)	142/2972 (4.8%)	164/2852 (5.8%)	82/1419 (5.8%)	43/762 (5.6%)	50/705 (7.1%)
aPR (95%CI)	0.88 (0.70-1.11)	Ref.	0.86 (0.65-1.16)	0.70 (0.47-1.03)	0.80 (0.52-1.25)
HIV+MSW (n/N, %)	0/70 (0.0%)	5/136 (3.7%)	4/221 (1.8%)	6/115 (5.2%)	0/41 (0.0%)
aPR (95%CI)	0.00 (0.00-1.47)	Ref.	0.45 (0.12-1.67)	1.02 (0.29-3.57)	0.00 (0.00-2.53)
HIV+MSW (n/N, %)	2/1094 (0.2%)	10/1585 (0.6%)	5/1315 (0.4%)	5/950 (0.5%)	0/217 (0.0%)
aPR (95%CI)	0.36 (0.08-1.65)	Ref.	0.60 (0.20-1.76)	0.31 (0.06-1.48)	0.00 (0.00-2.80)

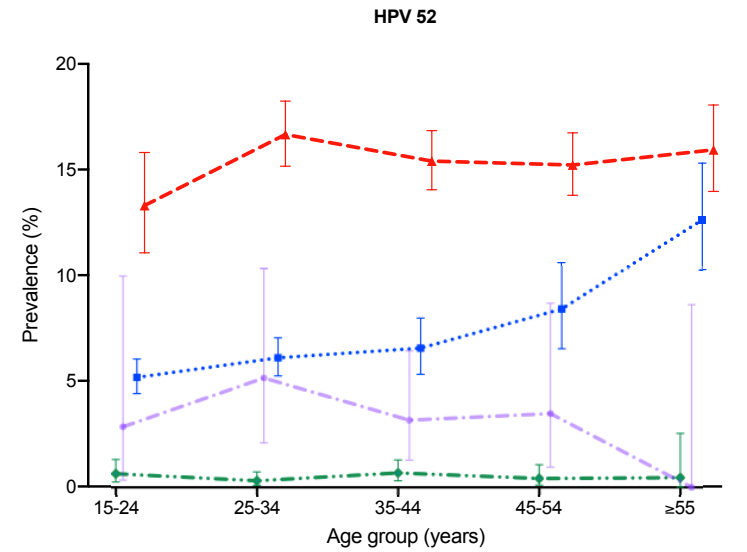
HPV 45



Category	15-24	25-34	35-44	45-54	≥55
HIV+MSM (n/N, %)	117/885 (13.2%)	351/2721 (12.9%)	397/2982 (13.3%)	277/2523 (11.0%)	118/1337 (8.8%)
aPR (95%CI)	1.07 (0.86-1.33)	Ref.	0.95 (0.82-1.09)	<b>0.78 (0.65-0.93)</b>	<b>0.61 (0.49-0.77)</b>
HIV+MSM (n/N, %)	131/3014 (4.3%)	134/3042 (4.4%)	83/1538 (5.4%)	66/797 (8.3%)	49/721 (6.8%)
aPR (95%CI)	0.82 (0.63-1.06)	Ref.	1.09 (0.81-1.47)	1.31 (0.92-1.87)	0.99 (0.64-1.53)
HIV+MSW (n/N, %)	2/71 (2.8%)	5/139 (3.6%)	7/233 (3.0%)	7/126 (5.6%)	1/45 (2.2%)
aPR (95%CI)	2.56 (0.54-12.2)	Ref.	0.89 (0.29-2.77)	1.85 (0.57-5.98)	1.26 (0.14-11.0)
HIV+MSW (n/N, %)	2/1094 (0.2%)	10/1585 (0.6%)	6/1315 (0.5%)	6/950 (0.6%)	2/217 (0.9%)
aPR (95%CI)	0.38 (0.08-1.75)	Ref.	0.80 (0.29-2.22)	1.10 (0.38-3.18)	1.35 (0.28-6.54)

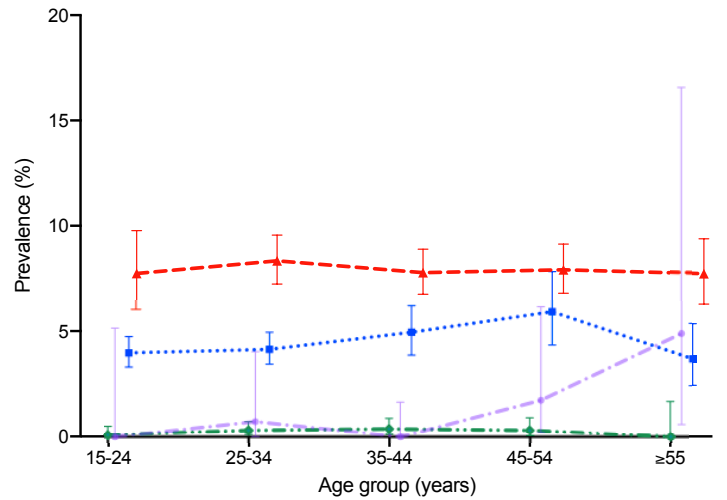


	15-24	25-34	35-44	45-54	≥55
<b>HIV+MSM (n/N, %)</b>	138/827 (16.7%)	359/2254 (15.9%)	350/2496 (14.0%)	238/2137 (11.1%)	126/1203 (10.5%)
<b>aPR (95%CI)</b>	0.97 (0.80-1.18)	Ref.	0.94 (0.81-1.08)	<b>0.79 (0.66-0.95)</b>	<b>0.71 (0.57-0.89)</b>
<b>HIV-MSM (n/N, %)</b>	230/2972 (7.7%)	189/2852 (6.6%)	108/1419 (7.6%)	69/762 (9.1%)	54/705 (7.7%)
<b>aPR (95%CI)</b>	1.01 (0.82-1.24)	Ref.	1.00 (0.78-1.28)	1.12 (0.81-1.54)	0.98 (0.66-1.47)
<b>HIV+MSW (n/N, %)</b>	1/70 (1.4%)	2/136 (1.5%)	13/221 (5.9%)	5/115 (4.3%)	1/41 (2.4%)
<b>aPR (95%CI)</b>	2.79 (0.28-28.3)	Ref.	4.18 (0.97-17.9)	3.13 (0.61-16.0)	1.45 (0.13-16.0)
<b>HIV-MSW (n/N, %)</b>	13/1094 (1.2%)	12/1585 (0.8%)	10/1315 (0.8%)	6/950 (0.6%)	4/217 (1.8%)
<b>aPR (95%CI)</b>	1.51 (0.67-3.38)	Ref.	1.03 (0.44-2.38)	0.98 (0.36-2.69)	1.85 (0.57-6.03)



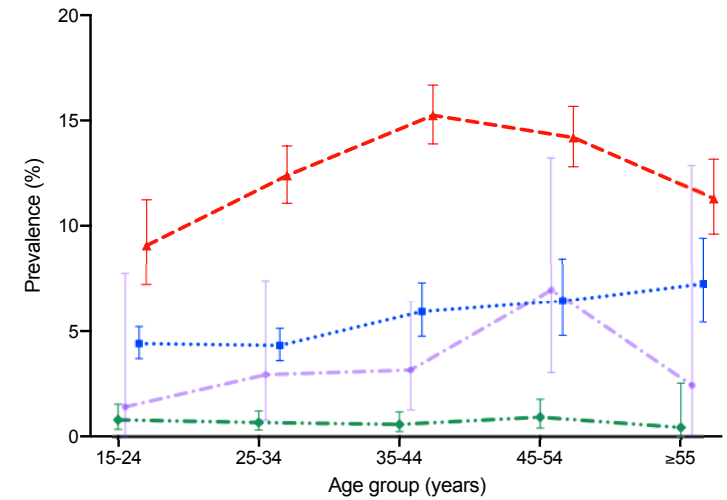
	15-24	25-34	35-44	45-54	≥55
<b>HIV+MSM (n/N, %)</b>	110/827 (13.3%)	386/2317 (16.7%)	404/2623 (15.4%)	357/2346 (15.2%)	203/1274 (15.9%)
<b>aPR (95%CI)</b>	<b>0.71 (0.57-0.88)</b>	Ref.	0.91 (0.80-1.04)	<b>0.81 (0.69-0.94)</b>	<b>0.74 (0.62-0.89)</b>
<b>HIV-MSM (n/N, %)</b>	154/2972 (5.2%)	174/2852 (6.1%)	93/1419 (6.6%)	64/762 (8.4%)	89/705 (12.6%)
<b>aPR (95%CI)</b>	0.89 (0.71-1.12)	Ref.	1.01 (0.77-1.31)	1.04 (0.75-1.46)	1.16 (0.80-1.69)
<b>HIV+MSW (n/N, %)</b>	2/70 (2.9%)	7/136 (5.1%)	7/221 (3.2%)	4/115 (3.5%)	0/41 (0.0%)
<b>aPR (95%CI)</b>	1.32 (0.31-5.54)	Ref.	0.52 (0.19-1.42)	0.60 (0.18-2.03)	0.00 (0.00-1.77)
<b>HIV-MSW (n/N, %)</b>	7/1094 (0.6%)	5/1585 (0.3%)	9/1315 (0.7%)	4/950 (0.4%)	1/217 (0.5%)
<b>aPR (95%CI)</b>	1.60 (0.50-5.14)	Ref.	2.58 (0.86-7.79)	1.46 (0.37-5.78)	1.61 (0.15-17.4)

HPV 56



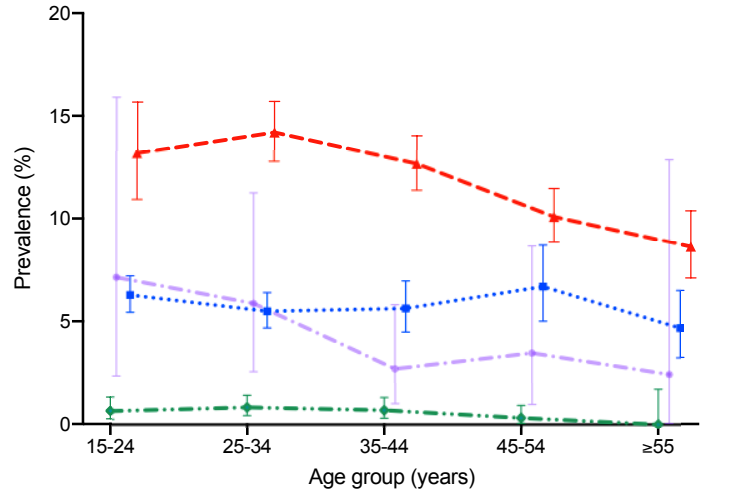
Category	15-24	25-34	35-44	45-54	≥55
HIV+MSM (n/N, %)	64/827 (7.7%)	188/2254 (8.3%)	194/2496 (7.8%)	169/2137 (7.9%)	93/1203 (7.7%)
aPR (95%CI)	0.75 (0.56-1.02)	Ref.	0.96 (0.78-1.18)	0.96 (0.75-1.23)	0.90 (0.67-1.20)
HIV-MSM (n/N, %)	118/2972 (4.0%)	118/2852 (4.1%)	70/1419 (4.9%)	45/762 (5.9%)	26/705 (3.7%)
aPR (95%CI)	0.92 (0.70-1.22)	Ref.	1.02 (0.74-1.41)	1.12 (0.75-1.69)	0.64 (0.37-1.10)
HIV+MSW (n/N, %)	0/70 (0.0%)	1/136 (0.7%)	0/221 (0.0%)	2/115 (1.7%)	2/41 (4.9%)
aPR (95%CI)	0.00 (0.00-)	Ref.	0.00 (0.00-2.53)	2.95 (0.28-31.5)	<b>8.88 (0.55-143.8)</b>
HIV-MSW (n/N, %)	1/1094 (0.1%)	5/1585 (0.3%)	5/1315 (0.4%)	3/950 (0.3%)	0/217 (0.0%)
aPR (95%CI)	0.26 (0.03-2.11)	Ref.	1.77 (0.49-6.37)	1.33 (0.38-4.67)	0.00 (0.00-5.62)

HPV 58



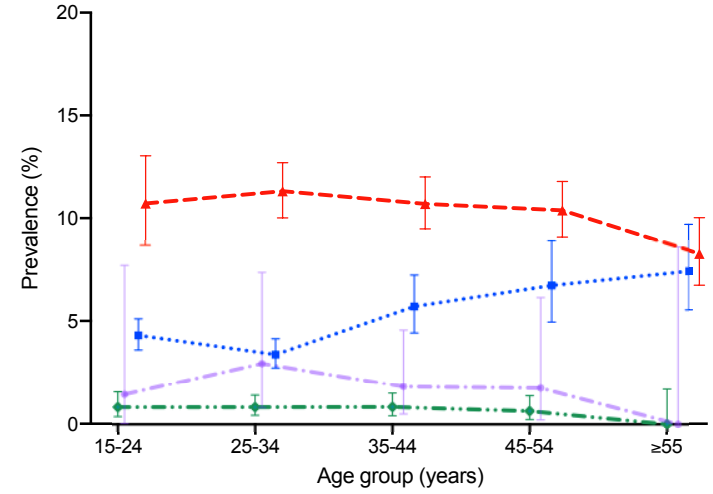
Category	15-24	25-34	35-44	45-54	≥55
HIV+MSM (n/N, %)	75/827 (9.1%)	287/2317 (12.4%)	400/2623 (15.2%)	333/2346 (14.2%)	144/1275 (11.3%)
aPR (95%CI)	<b>0.68 (0.52-0.87)</b>	Ref.	<b>1.19 (1.02-1.38)</b>	1.04 (0.87-1.23)	0.81 (0.66-1.01)
HIV-MSM (n/N, %)	131/2972 (4.4%)	123/2852 (4.3%)	84/1419 (5.9%)	49/762 (6.4%)	51/705 (7.2%)
aPR (95%CI)	0.99 (0.77-1.28)	Ref.	<b>1.78 (1.33-2.37)</b>	<b>2.04 (1.41-2.96)</b>	<b>2.78 (1.76-4.39)</b>
HIV+MSW (n/N, %)	1/70 (1.4%)	4/136 (2.9%)	7/221 (3.2%)	8/115 (7.0%)	1/41 (2.4%)
aPR (95%CI)	1.34 (0.16-11.6)	Ref.	1.03 (0.31-3.46)	1.74 (0.51-5.98)	0.57 (0.06-5.15)
HIV-MSW (n/N, %)	9/1094 (0.8%)	11/1585 (0.7%)	8/1315 (0.6%)	9/950 (0.9%)	1/217 (0.5%)
aPR (95%CI)	1.30 (0.54-3.15)	Ref.	0.71 (0.29-1.77)	0.79 (0.33-1.92)	0.82 (0.09-7.21)

HPV 59



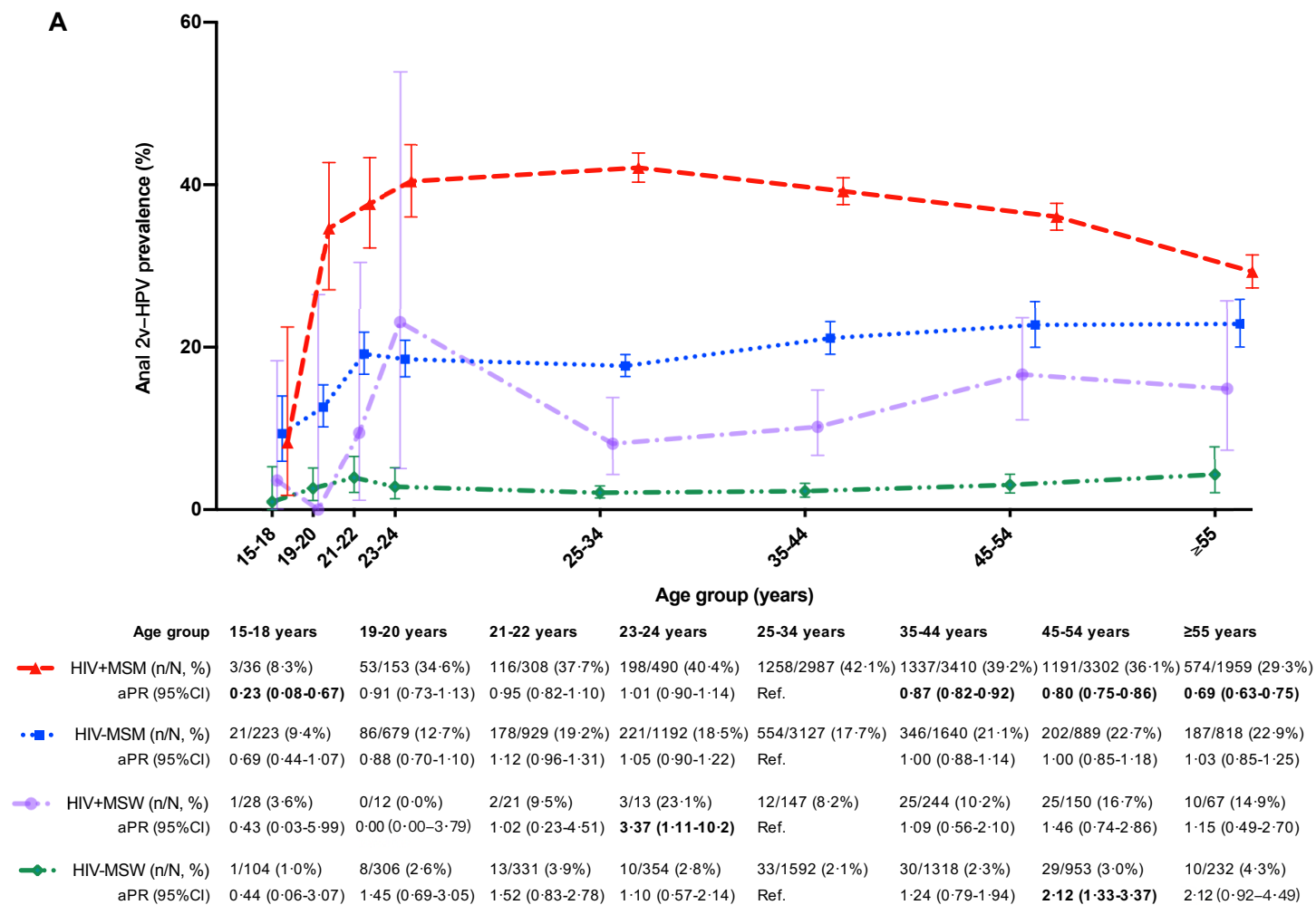
Category	15-24	25-34	35-44	45-54	≥55
HIV+MSM (n/N, %)	109/827 (13.2%)	320/2254 (14.2%)	316/2496 (12.7%)	216/2137 (10.1%)	104/1203 (8.6%)
aPR (95%CI)	1.04 (0.83-1.30)	Ref.	0.89 (0.77-1.04)	<b>0.76 (0.63-0.69)</b>	<b>0.64 (0.50-0.82)</b>
HIV-MSM (n/N, %)	187/2972 (6.3%)	157/2852 (5.5%)	80/1419 (5.6%)	51/762 (6.7%)	33/705 (4.7%)
aPR (95%CI)	1.06 (0.85-1.32)	Ref.	1.05 (0.78-1.41)	0.99 (0.67-1.45)	0.65 (0.40-1.06)
HIV+MSW (n/N, %)	5/70 (7.1%)	8/136 (5.9%)	6/221 (2.7%)	4/115 (3.5%)	1/41 (2.4%)
aPR (95%CI)	1.38 (0.34-5.63)	Ref.	0.46 (0.17-1.29)	0.55 (0.15-2.07)	0.41 (0.04-4.69)
HIV-MSW (n/N, %)	7/1094 (0.6%)	13/1585 (0.8%)	9/1315 (0.7%)	3/950 (0.3%)	0/217 (0.0%)
aPR (95%CI)	0.52 (0.20-1.34)	Ref.	0.82 (0.34-2.00)	0.32 (0.07-1.45)	0.00 (0.00-2.15)

HPV 68



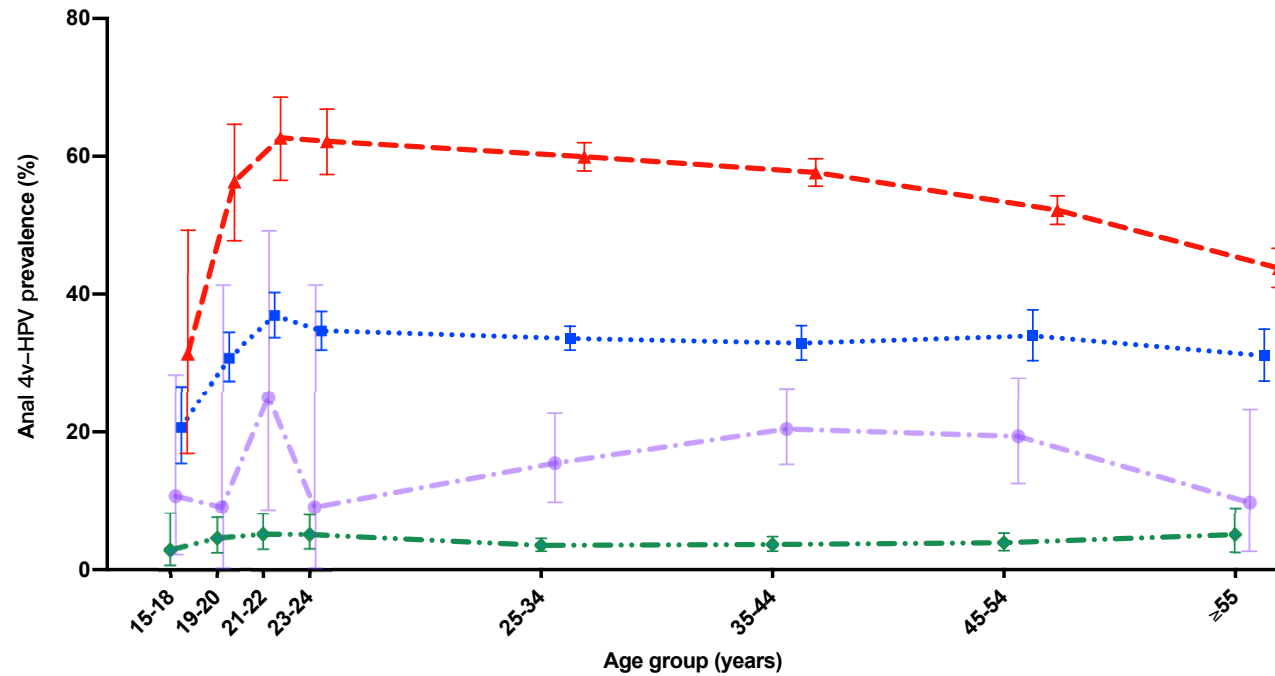
Category	15-24	25-34	35-44	45-54	≥55
HIV+MSM (n/N, %)	88/821 (10.7%)	250/2210 (11.3%)	255/2384 (10.7%)	210/2023 (10.4%)	95/1148 (8.3%)
aPR (95%CI)	0.87 (0.68-1.12)	Ref.	0.90 (0.75-1.07)	<b>0.77 (0.63-0.96)</b>	<b>0.58 (0.44-0.76)</b>
HIV-MSM (n/N, %)	126/2921 (4.3%)	89/2628 (3.4%)	64/1120 (5.7%)	45/668 (6.7%)	49/660 (7.4%)
aPR (95%CI)	1.26 (0.95-1.67)	Ref.	<b>1.56 (1.09-2.24)</b>	1.51 (0.97-2.36)	<b>1.79 (1.09-2.94)</b>
HIV+MSW (n/N, %)	1/70 (1.4%)	4/136 (2.9%)	4/221 (1.8%)	2/115 (1.7%)	0/41 (0.0%)
aPR (95%CI)	0.79 (0.02-8.12)	Ref.	0.60 (0.15-2.37)	0.55 (0.10-3.05)	0.00 (0.00-5.22)
HIV-MSW (n/N, %)	9/1094 (0.8%)	13/1585 (0.8%)	11/1315 (0.8%)	6/950 (0.6%)	0/217 (0.0%)
aPR (95%CI)	0.76 (0.32-1.79)	Ref.	0.99 (0.44-2.22)	0.69 (0.25-1.86)	0.00 (0.00-2.15)

**Appendix Figure 2: Age-specific prevalence of A) 2v-HPV, B) 4v-HPV, and C) 9v-HPV infection in four male risk groups.** Error bars show 95% CIs. PRs were adjusted for study. HPV=human papillomavirus. 2v-HPV=HPV16 and 18. 4v-HPV=HPV6, 11, 16, and 18. 9v-HPV=HPV6, 11, 16, 18, 31, 33, 45, 52, and 58. HIV+=HIV positive. HIV-=HIV negative. MSM=men who have sex with men. MSW=men who have sex with women. aPR=adjusted prevalence ratio. Significant aPRs relative to the reference group are shown in bold.



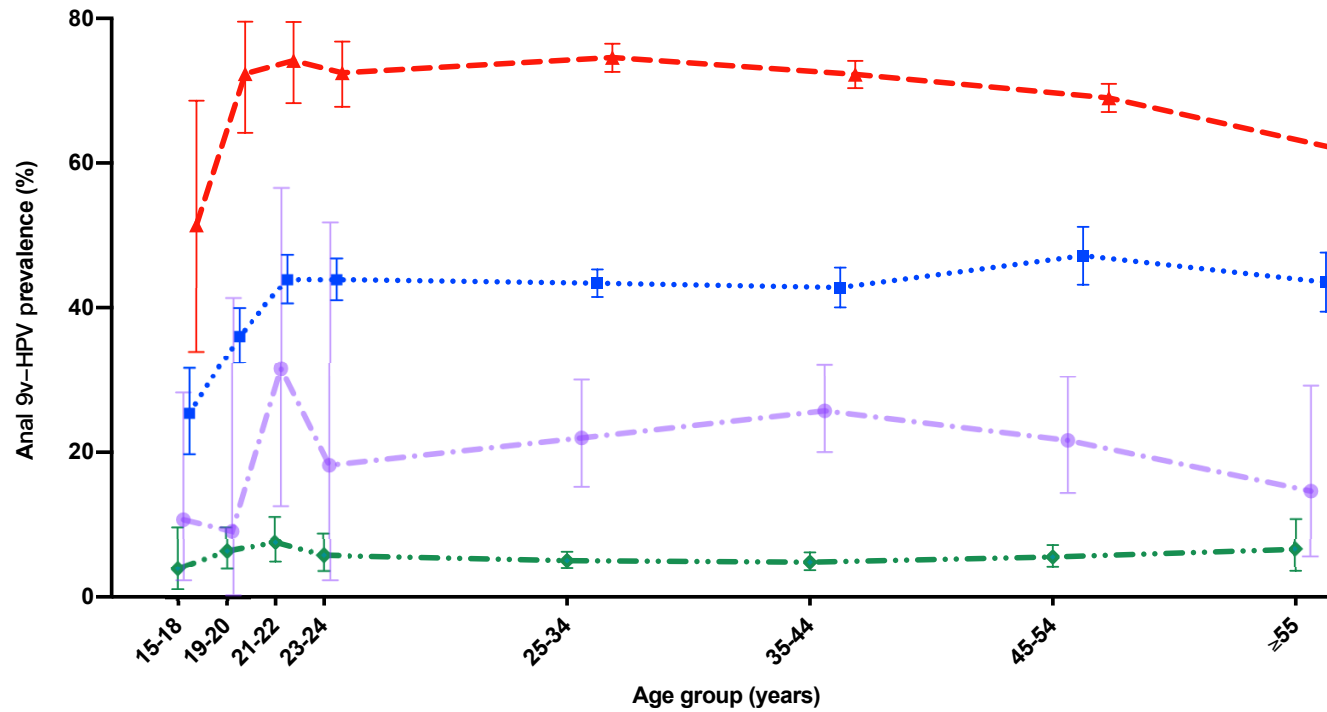


B



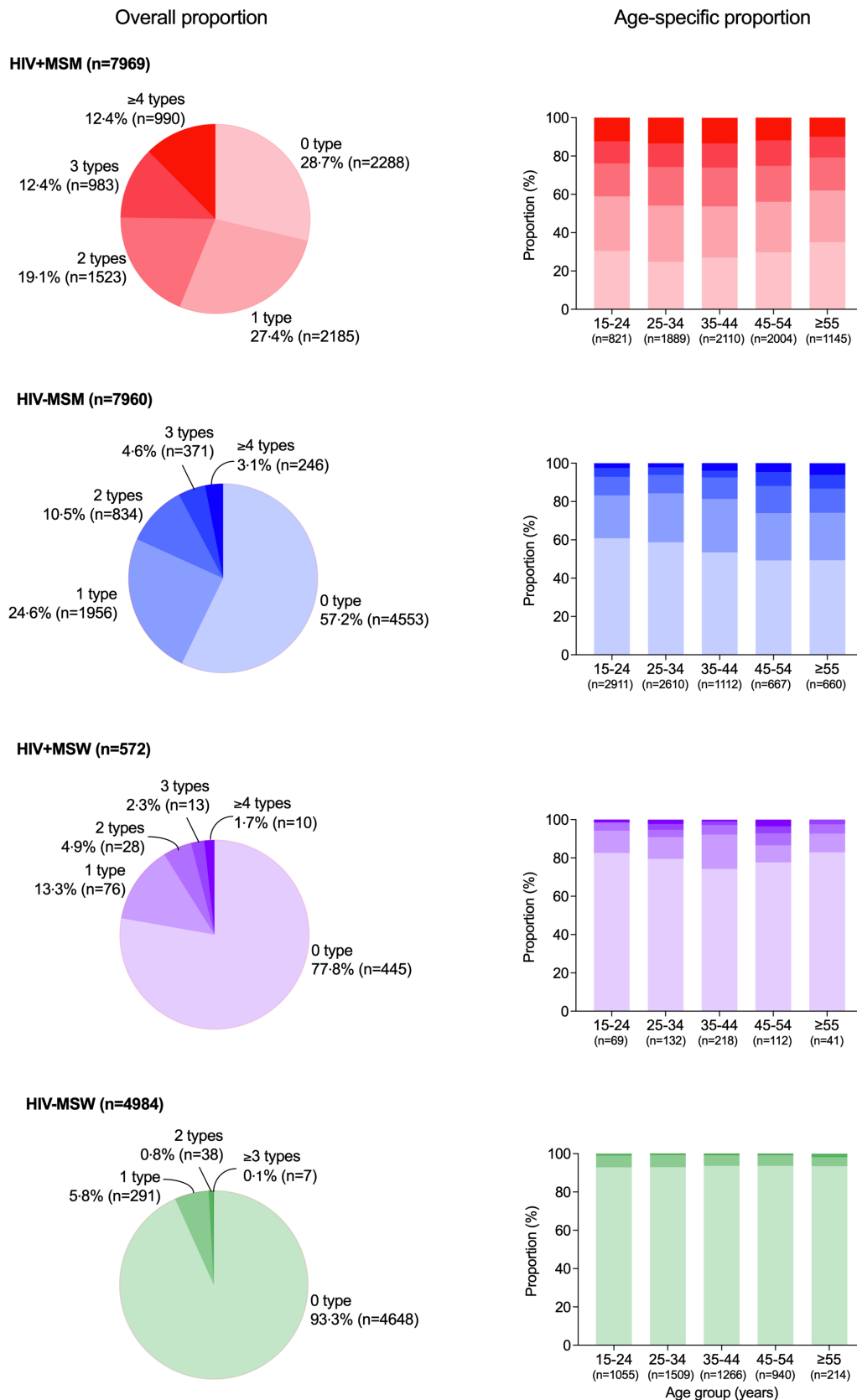
	Age group	15-18 years	19-20 years	21-22 years	23-24 years	25-34 years	35-44 years	45-54 years	≥55 years
<span style="color: red;">—▲</span>	HIV+MSM (n/N, %)	11/35 (31.4%)	80/142 (56.3%)	163/260 (62.7%)	260/418 (62.2%)	1326/2212 (59.9%)	1400/2428 (57.7%)	1190/2280 (52.2%)	532/1215 (43.8%)
	aPR (95%CI)	<b>0.60 (0.37-0.95)</b>	1.00 (0.87-1.16)	1.08 (0.99-1.18)	1.06 (0.98-1.14)	Ref.	<b>0.92 (0.88-0.96)</b>	<b>0.86 (0.82-0.91)</b>	<b>0.76 (0.70-0.82)</b>
<span style="color: blue;">-■-</span>	HIV-MSM (n/N, %)	45/219 (20.5%)	200/650 (30.8%)	322/872 (36.9%)	400/1153 (34.7%)	973/2898 (33.6%)	459/1396 (32.9%)	223/657 (33.9%)	187/602 (31.1%)
	aPR (95%CI)	0.76 (0.57-1.00)	1.11 (0.97-1.27)	<b>1.15 (1.04-1.28)</b>	1.07 (0.97-1.18)	Ref.	0.94 (0.86-1.03)	0.97 (0.86-1.10)	0.95 (0.80-1.13)
<span style="color: purple;">-●-</span>	HIV+MSW (n/N, %)	3/28 (10.7%)	1/11 (9.1%)	5/20 (25.0%)	1/11 (9.1%)	21/136 (15.4%)	45/221 (20.4%)	22/114 (19.3%)	4/41 (9.8%)
	aPR (95%CI)	2.73 (0.56-13.3)	1.41 (0.22-9.12)	<b>4.28 (1.70-10.7)</b>	0.73 (0.11-4.83)	Ref.	1.30 (0.80-2.11)	1.26 (0.71-2.23)	0.70 (0.24-2.04)
<span style="color: green;">-◆-</span>	HIV-MSW (n/N, %)	3/104 (2.9%)	14/306 (4.6%)	17/331 (5.1%)	18/353 (5.1%)	56/1585 (3.5%)	48/1314 (3.7%)	37/949 (3.9%)	11/216 (5.1%)
	aPR (95%CI)	0.95 (0.32-2.79)	1.52 (0.88-2.63)	1.25 (0.76-2.08)	1.34 (0.82-2.21)	Ref.	1.27 (0.87-1.85)	<b>1.59 (1.05-2.41)</b>	1.36 (0.70-2.62)

C

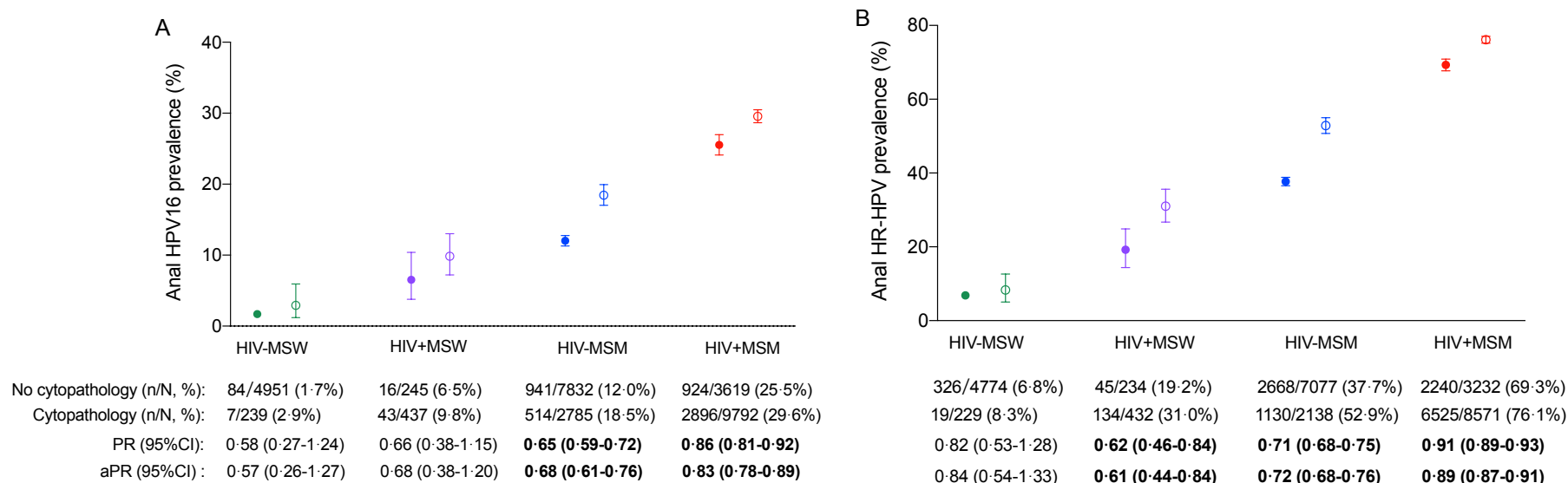


	Age group	15-18 years	19-20 years	21-22 years	23-24 years	25-34 years	35-44 years	45-54 years	≥55 years
—▲—	HIV+MSM (n/N, %)	18/35 (51.4%)	102/141 (72.3%)	184/248 (74.2%)	287/396 (72.5%)	1471/1972 (74.6%)	1632/2258 (72.3%)	1540/2231 (69.0%)	748/1209 (61.9%)
	aPR (95%CI)	0.80 (0.59-1.09)	1.02 (0.91-1.14)	1.02 (0.95-1.09)	0.99 (0.93-1.06)	Ref.	<b>0.95 (0.92-0.98)</b>	<b>0.92 (0.89-0.96)</b>	<b>0.84 (0.79-0.88)</b>
•■•	HIV+MSM (n/N, %)	55/217 (25.3%)	232/643 (36.1%)	375/854 (43.9%)	495/1128 (43.9%)	1167/2690 (43.4%)	543/1269 (42.8%)	293/621 (47.2%)	255/586 (43.5%)
	aPR (95%CI)	<b>0.71 (0.56-0.91)</b>	0.94 (0.84-1.06)	1.00 (0.92-1.09)	0.98 (0.90-1.06)	Ref.	0.97 (0.90-1.05)	1.02 (0.92-1.12)	0.96 (0.83-1.09)
—●—	HIV+MSW (n/N, %)	3/28 (10.7%)	1/11 (9.1%)	6/19 (31.6%)	2/11 (18.2%)	29/132 (22.0%)	56/218 (25.7%)	24/111 (21.6%)	6/41 (14.6%)
	aPR (95%CI)	2.12 (0.51-8.78)	0.97 (0.15-6.36)	<b>4.17 (2.05-8.49)</b>	1.11 (0.32-3.84)	Ref.	1.12 (0.76-1.67)	0.97 (0.59-1.59)	0.71 (0.30-1.65)
—◆—	HIV+MSW (n/N, %)	4/103 (3.9%)	19/303 (6.3%)	24/317 (7.6%)	19/332 (5.7%)	76/1509 (5.0%)	61/1265 (4.8%)	52/939 (5.5%)	14/213 (6.6%)
	aPR (95%CI)	0.86 (0.35-2.12)	1.62 (0.98-2.66)	1.39 (0.91-2.12)	1.13 (0.71-1.78)	Ref.	1.13 (0.81-1.57)	1.32 (0.92-1.89)	1.26 (0.70-2.26)

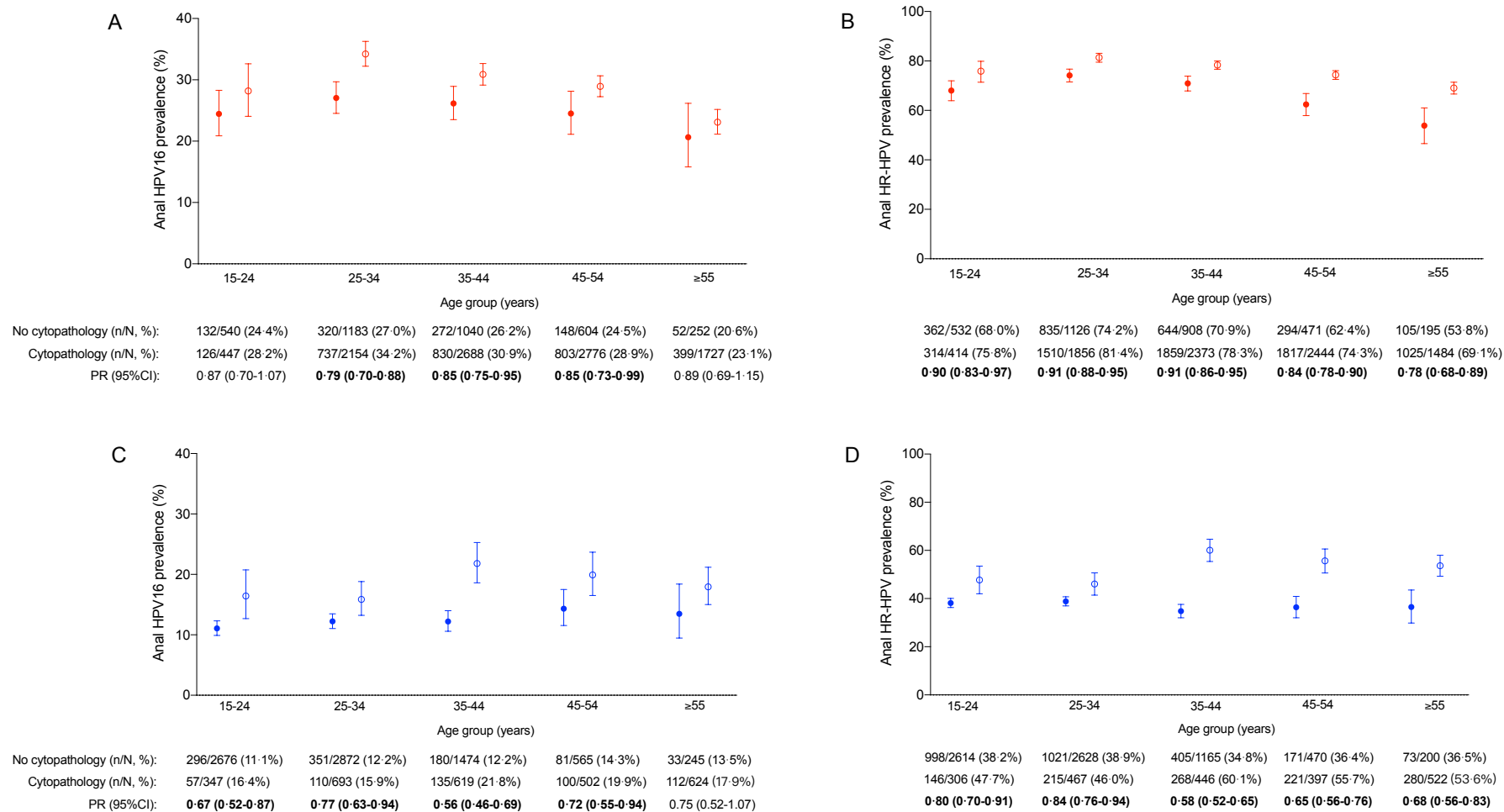
**Appendix Figure 3: Overall and age-specific distribution of number of HR-HPV infections in four male risk groups.** HR-HPV=high-risk human papillomavirus=HPV16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, and 68. HIV+=HIV positive; HIV-=HIV negative. MSM=men who have sex with men. MSW=men who have sex with women.



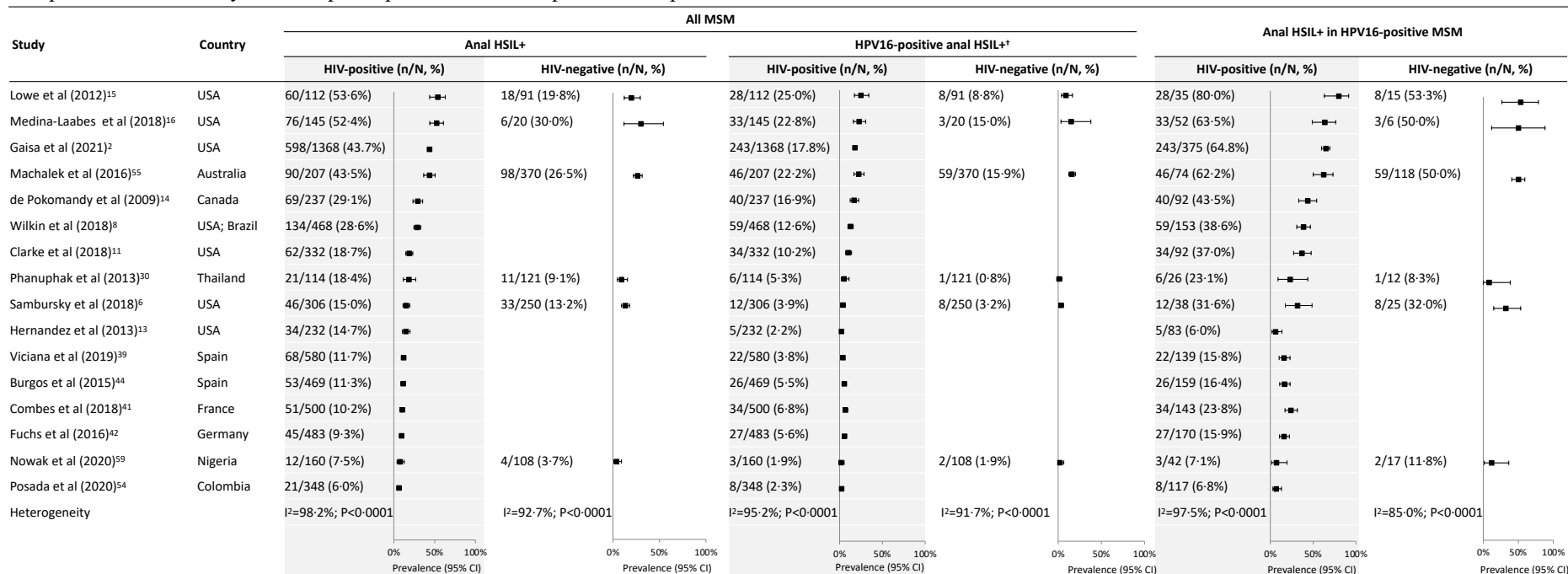
**Appendix Figure 4: Prevalence of A) HPV16 and B) HR-HPV infection in four male risk groups with or without cytopathological data.** Error bars show 95% CIs. PRs were adjusted for age group. HR-HPV=high-risk human papillomavirus=HPV16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, and 68. HIV+=HIV positive. HIV-=HIV negative. MSM=men who have sex with men. MSW=men who have sex with women. PR=prevalence ratio (no cytopathology versus cytopathology). aPR=adjusted prevalence ratio (no cytopathology versus cytopathology). Significant PRs and aPRs relative to the reference group are shown in bold. Solid circles indicate men without cytopathological data, and open circles indicate men with cytopathological data.



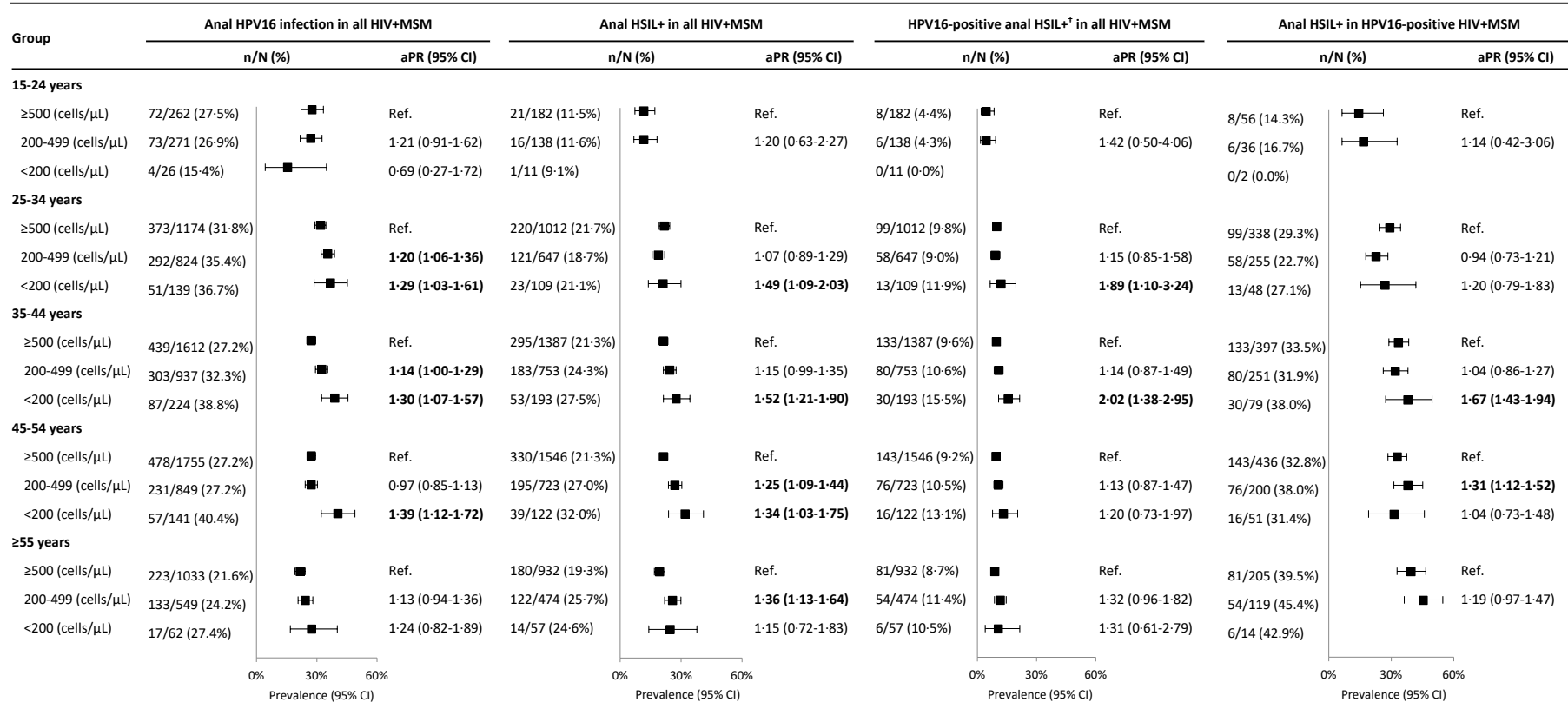
**Appendix Figure 5: Prevalence of anal HPV infection in men with or without cytopathological data by age group: A) HPV16 in HIV-positive MSM, B) HR-HPV in HIV-positive MSM, C) HPV16 in HIV-negative MSM, and D) HR-HPV in HIV-negative MSM.** Error bars show 95% CIs. HR-HPV=high-risk human papillomavirus=HPV16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, and 68. MSM=men who have sex with men. PR=prevalence ratio (no cytopathology versus cytopathology). Significant PRs relative to the reference group are shown in bold. Solid circles indicate men without cytopathological data, and open circles indicate men with cytopathological data.



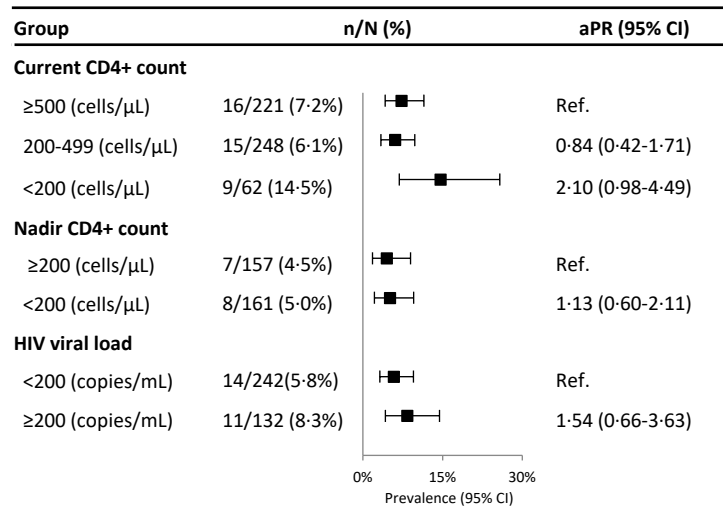
**Appendix Figure 6: Prevalence of anal histological HSIL+ in studies that performed HRA in all participants.** Error bars show 95% CIs. HPV=human papillomavirus. HSIL+=high-grade squamous intraepithelial lesions and worse. MSM=men who have sex with men. These studies are ranked in descending order of HSIL+ prevalence in HIV-positive MSM. \*Only includes participants with HSIL+ plus HPV16-positive swabs.



**Appendix Figure 7: Prevalence of anal HPV16 and anal HSIL+ in HIV-positive MSM, according to current CD4+ cell count, stratified by age group.** Error bars show 95% CIs. PRs were adjusted for study. HPV=human papillomavirus. HIV+=HIV positive. HSIL+=high-grade squamous intraepithelial lesions and worse. MSM=men who have sex with men. aPR=aadjusted prevalence ratio. Significant aPRs relative to the reference group are shown in bold. \*Only includes participants with HSIL+ plus HPV16-positive swabs. Note: The points (with 95% CIs) and aPRs (with 95% CIs) are not shown if the denominators were below 20.



**Appendix Figure 8: Prevalence of anal HPV16 in HIV-positive MSW, according to current CD4+ cell count, nadir CD4+ cell count, and HIV viral load.** Error bars show 95% CIs. PRs were adjusted for age group and study. HPV=human papillomavirus. MSW=men who have sex with women. aPR=adjusted prevalence ratio.





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