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Supplementary appendix

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

This online publication has been corrected. The corrected version first appeared at thelancet.com/lancetgh on November 20, 2020.

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SUPPLEMENTARY MATERIAL

Estimates of the global burden of cervical cancer associated with HIV

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Table 1: Search strings for all five databases

	HIV & Cervical Cancer Translate: Pubmed, Embase, GIM, Web of Science, CABI Filters: Epidemiological, Database source, Publication Type Created by: Kavita Kothari/Tomas Allen (librarians)

PUBMED DATABASE

#	**Searches**
1	"HIV Infections"[Mesh] OR "HIV"[MeSH] OR "hiv"[tw] OR "hiv-1"[tw] OR "hiv-2"[tw] OR "hiv1"[tw] OR "hiv2"[tw] OR hiv infect*[tw] OR "human immunodeficiency virus"[tw] OR "human immunedeficiency virus"[tw] OR "human immuno-deficiency virus"[tw] OR "human immune-deficiency virus"[tw] OR ((human immun*) AND ("deficiency virus"[tw])) OR "acquired immunodeficiency syndrome"[tw] OR "acquired immunedeficiency syndrome"[tw] OR "acquired immuno-deficiency syndrome"[tw] OR "acquired immune-deficiency syndrome"[tw] OR ((acquired immun*) AND ("deficiency syndrome"[tw])) OR "Sexually Transmitted Diseases, Viral"[MeSH:NoExp] OR "HIV Long-Term Survivors"[Mesh]
2	"Uterine Cervical Neoplasms"[MeSH Terms] OR "cervical cancer"[Tiab] OR "Cancer of Cervix" [TiAb] OR "Cancer of the Cervix" [TiAB] OR Cervical Neoplasia* [TiAB] OR Cervix Neoplasm*[tiab] OR "Neoplastic Cervix" [TiAB] OR ((Cervix[tiab] OR Cervical[tiab]) AND (Cancer[tiab] OR Cancers[tiab] OR Cancerous[tiab] OR Carcinoma[tiab] OR Neoplasia*[tiab] OR Neoplasm*[tiab] OR Neoplastic[tiab]))
3	((Cervix[tiab] OR Cervical[tiab]) AND (preCancer[tiab] OR preCancerous[tiab] OR dysplasia[tiab] OR abnormal growth[tiab] OR "atypical squamous"[tiab] OR "Intraepithelial lesions"[tiab])) OR "Atypical Squamous Cells of the Cervix"[Mesh] OR "Squamous Intraepithelial Lesions of the Cervix"[Mesh] OR "Uterine Cervical Dysplasia"[Mesh]
4	Papillomaviridae [MeSH Terms] OR papillomaviridae[Tiab] "human papilloma virus infection"[TIAB] OR "human papillomavirus infection"[TiAb] OR hpv[TiAb] OR "Human papillomaviruses"[Tiab]
5	prevalence[TW] OR incidence[TW] OR epidemiol*[TW] OR survey[TW] OR "rapid assessment"[TW] OR "situation assessment"[TW] OR "situational assessment"[TW] OR rar[TW] OR cohort[TW] OR surveillance[TW] OR seroprevalence[TW] OR seroincidence[TW] OR seroepidemiol*[TW] OR screening[TW] OR mortality[tiab] OR mortalities[tiab] OR mortal[tiab] OR dead[Tiab] OR death[tiab] OR deaths[tiab] OR decease*[tiab] O R demise*[tiab] OR die[tiab] OR died[tiab] OR dies[tiab] OR dying[tiab] OR fatal[tiab] OR fatality[tiab] OR fatalities[tiab] OR non-survival*[tiab] OR Nonsurvival*[tiab] OR survival*[tiab] OR lethality[tiab] OR "epidemiologic methods"[Mesh] OR "epidemiologic studies"[Mesh] OR "sentinel surveillance"[Mesh] OR "seroepidemiologic studies"[Mesh] OR "cohort studies"[Mesh] OR "longitudinal studies"[Mesh] OR "follow-up studies"[Mesh] OR "prospective studies"[Mesh] OR "Diagnostic Services"[Mesh] OR "Mass Screening"[Mesh] OR "Mortality"[Mesh] OR "mortality"[Subheading] OR "Hospital Mortality"[Mesh] OR "Death"[Mesh] OR "Cause of Death"[Mesh] OR "Death Certificates"[Mesh] OR "Fatal Outcome"[Mesh] OR "Autopsy"[Mesh] OR "Survival Rate"[Mesh]
6	#1 AND (#2 OR #3 OR #4)
7	#6 AND #5
8	NOT ("animals"[MeSH] NOT "humans"[MeSH]) AND "humans"[MeSH]

EMBASE DATABASE

#	Searches
1	'human immunodeficiency virus infection'/exp OR 'human immunodeficiency virus'/exp OR 'hiv survivor'/exp OR hiv:ti,ab,kw OR 'hiv-1':ti,ab,kw OR 'hiv-2':ti,ab,kw OR 'human immunodeficiency virus':ti,ab,kw OR 'human immuno deficiency':ti,ab,kw OR 'human immunedeficiency virus':ti,ab,kw OR 'human immune deficiency virus':ti,ab,kw OR 'human immune-deficiency virus':ti,ab,kw OR 'acquired immune-deficiency syndrome':ti,ab,kw OR 'acquired immunedeficiency syndrome':ti,ab,kw OR 'acquired immunodeficiency syndrome':ti,ab,kw OR 'acquired immuno-deficiency syndrome':ti,ab,kw
2	'uterine cervix tumor'/exp OR 'cervical cancer':ti,ab,kw OR 'cancer of cervix':ti,ab,kw OR 'cancer of the cervix':ti,ab,kw OR 'neoplastic cervix':ti,ab,kw OR ((cervix:ti,ab,kw OR cervical:ti,ab,kw) AND (cancer:ti,ab,kw OR cancers:ti,ab,kw OR cancerous:ti,ab,kw OR carcinoma:ti,ab,kw OR neoplasia*:ti,ab,kw OR neoplasm*:ti,ab,kw OR neoplastic:ti,ab,kw))
3	((Cervix:ti,ab,kw OR Cervical:ti,ab,kw) AND (preCancer:ti,ab,kw OR preCancerous:ti,ab,kw OR dysplasia:ti,ab,kw OR 'abnormal growth':ti,ab,kw OR 'atypical squamous':ti,ab,kw OR 'Intraepithelial lesions':ti,ab,kw)) OR 'Atypical Squamous Cells of the Cervix'/exp OR 'squamous intraepithelial lesion of the cervix'/exp OR 'uterine cervix dysplasia'/exp
4	'Papillomaviridae'/exp OR 'papillomaviridae':ti,ab,kw OR ‘human papilloma virus infection':ti,ab,kw OR 'human papillomavirus infection':ti,ab,kw OR hpv:ti,ab,kw OR 'Human papillomaviruses':ti,ab,kw
5	prevalence:ti,ab,de OR incidence:ti,ab,de OR epidemiol*:ti,ab,de OR survey:ti,ab,de OR 'rapid assessment':ti,ab,de OR 'situation assessment':ti,ab,de OR 'situational assessment':ti,ab,de OR rar:ti,ab,de OR cohort:ti,ab,de OR surveillance:ti,ab,de OR seroprevalence:ti,ab,de OR seroincidence:ti,ab,de OR seroepidemiol*:ti,ab,de OR screening:ti,ab,de OR 'mass screening':ti,ab,de OR mortality:ti,ab OR mortalities:ti,ab OR mortal:ti,ab OR dead:ti,ab OR death:ti,ab OR deaths:ti,ab OR decease*:ti,ab OR demise*:ti,ab OR die:ti,ab OR died:ti,ab OR dies:ti,ab OR dying:ti,ab OR fatal:ti,ab OR fatality:ti,ab OR fatalities:ti,ab OR non-survival*:ti,ab OR Nonsurvival*:ti,ab OR survival*:ti,ab OR lethality:ti,ab OR epidemiology:de OR 'Cancer epidemiology'/exp OR 'cancer statistics'/exp OR 'disease surveillance'/exp OR 'health survey'/exp OR 'incidence'/exp OR 'infection rate'/exp OR 'prevelance'/exp OR 'sentinel surveillance'/exp OR 'seroepidemiology'/exp OR 'cohort analysis'/exp OR 'longitudinal study'/exp OR 'prospective study'/exp OR 'preventive health service'/exp OR 'mass screening'/exp OR 'cancer mortality'/exp OR 'all cause mortality'/exp OR 'mortality':de OR 'hospital mortality'/exp OR 'mortality rate'/exp OR 'death'/exp OR 'cause of death'/exp OR 'dying'/exp OR 'fatality'/exp OR 'lethality'/exp OR 'death certificate'/exp OR 'autopsy'/exp OR 'cancer survival'/exp OR 'survival rate'/exp
6	#2 OR #3 OR #4
7	#6 AND #1
8	#7 AND #5
9	#5 AND #7 AND [embase]/lim
10	#5 AND #7 AND [embase]/lim NOT ('letter'/it OR 'editorial'/it OR 'note'/it)
	No human filter is used in embase since it is known not to be reliable.

Global Health DATABASE

#	Searches
1	DE "HIV infections" OR DE "HIV-1 infections" OR DE "HIV-2 infections" OR DE "HIV-1 infections" OR DE "HIV-2 infections" OR "human immunodeficiency viruses" OR DE "Human immunodeficiency virus 1" OR DE "Human immunodeficiency virus 2" OR TX ("hiv" OR "hiv-1" OR "hiv-2" OR "hiv1" OR "hiv2" OR hiv infect* OR "human immunodeficiency virus" OR "human immunedeficiency virus" OR "human immuno-deficiency virus" OR "human immune-deficiency virus" OR ((human immun*) AND ("deficiency virus")) OR "acquired immunodeficiency syndrome" OR "acquired immunedeficiency syndrome" OR "acquired immuno-deficiency syndrome" OR "acquired immune-deficiency syndrome" OR ((acquired immun*) AND ("deficiency syndrome")))
2	DE "cervical cancer" OR TI ("cervical cancer" OR "Cancer of Cervix" OR "Cancer of the Cervix" OR Cervical Neoplasia* OR Cervix Neoplasm* OR "Neoplastic Cervix" OR ((Cervix OR Cervical) AND (Cancer OR Cancers OR Cancerous OR Carcinoma OR Neoplasia* OR Neoplasm* OR Neoplastic))) OR AB ("cervical cancer" OR "Cancer of Cervix" OR "Cancer of the Cervix" OR Cervical Neoplasia* OR Cervix Neoplasm* OR "Neoplastic Cervix" OR ((Cervix OR Cervical) AND (Cancer OR Cancers OR Cancerous OR Carcinoma OR Neoplasia* OR Neoplasm* OR Neoplastic)))
3	TI((Cervix OR Cervical) AND (preCancer OR preCancerous OR dysplasia OR abnormal growth OR "atypical squamous" OR "Intraepithelial lesions")) OR AB((Cervix OR Cervical) AND (preCancer OR preCancerous OR dysplasia OR abnormal growth OR "atypical squamous" OR "Intraepithelial lesions")) OR DE "cervical intraepithelial neoplasia"
4	DE "Papillomavirus" OR DE "Papillomavirus" OR TI (papillomaviridae "human papilloma virus infection" OR "human papillomavirus infection" OR hpv OR "Human papillomaviruses") OR AB (papillomaviridae "human papilloma virus infection" OR "human papillomavirus infection" OR hpv OR "Human papillomaviruses")
5	TX(prevalence OR incidence OR epidemiol* OR survey OR "rapid assessment" OR "situation assessment" OR "situational assessment" OR rar OR cohort OR surveillance OR seroprevalence OR seroincidence OR seroepidemiol* OR screening) OR TI(mortality OR mortalities OR mortal OR dead OR death OR deaths OR decease* OR demise* OR die OR died OR dies OR dying OR fatal OR fatality OR fatalities OR non-survival* OR Nonsurvival* OR survival* OR lethality) OR AB(mortality OR mortalities OR mortal OR dead OR death OR deaths OR decease* OR demise* OR die OR died OR dies OR dying OR fatal OR fatality OR fatalities OR non-survival* OR Nonsurvival* OR survival* OR lethality) OR DE "epidemiology" OR DE "disease surveys" OR DE "incidence" OR DE "disease incidence" OR DE "sentinel surveillance" OR DE "serological surveys" OR DE "longitudinal studies" OR DE "mortality" OR DE "death and dying" OR DE "causes of death" OR DE "death" OR DE "postmortem examinations" OR DE "survival"
6	#2 OR #3 OR #4
7	#6 AND #1
8	#7 AND #5

Web of Science DATABASE

#	Searches
1	TS=(“hiv” OR “hiv-1” OR “hiv-2” OR “hiv1” OR “hiv2” OR hiv infect* OR “human immunodeficiency virus” OR “human immunedeficiency virus” OR “human immuno-deficiency virus” OR “human immune-deficiency virus” OR ((human immun*) AND (“deficiency virus”)) OR “acquired immunodeficiency syndrome” OR “acquired immunedeficiency syndrome” OR “acquired immuno-deficiency syndrome” OR “acquired immune-deficiency syndrome” OR ((acquired immun*) AND (“deficiency syndrome”)))
2	TS=(“cervical cancer” OR “Cancer of Cervix” OR “Cancer of the Cervix” OR Cervical Neoplasia* OR Cervix Neoplasm* OR “Neoplastic Cervix” OR ((Cervix OR Cervical) AND (Cancer OR Cancers OR Cancerous OR Carcinoma OR Neoplasia* OR Neoplasm* OR Neoplastic)))
3	TS=(“cervical cancer” OR “Cancer of Cervix” OR “Cancer of the Cervix” OR Cervical Neoplasia* OR Cervix Neoplasm* OR “Neoplastic Cervix” OR ((Cervix OR Cervical) AND (Cancer OR Cancers OR Cancerous OR Carcinoma OR Neoplasia* OR Neoplasm* OR Neoplastic)))
4	TS=(Papillomaviridae OR papillomaviridae "human papilloma virus infection" OR "human papillomavirus infection" OR hpv OR "Human papillomaviruses")
5	TS=(prevalence OR incidence OR epidemiol* OR survey OR "rapid assessment" OR "situation assessment" OR "situational assessment" OR rar OR cohort OR surveillance OR seroprevalence OR seroincidence OR seroepidemiol* OR screening OR mortality OR mortalities OR mortal OR dead OR death OR deaths OR decease* OR demise* OR die OR died OR dies OR dying OR fatal OR fatality OR fatalities OR non-survival* OR Nonsurvival* OR survival* OR lethality OR "longitudinal studies" OR "follow-up studies" OR "prospective studies" OR "Mass Screening" OR "Autopsy")
6	#1 AND (#2 OR #3 OR #4)
7	w/ numerical filter

Global Index Medicus (GIM)

#	**Searches**
1	(Cervix OR Cervical)
2	(precancer* OR squamous OR Intraepithelial OR Cancer* OR Carcinoma OR Neoplasia OR Neoplasm* OR Neoplastic)
3	Papillomaviridae OR papilloma OR papillomavirus* OR hpv
4	AIDS OR HIV OR hiv1 OR hiv2 OR (immunodeficiency virus) OR (immune deficiency virus) OR (acquired immunodeficiency) OR (acquired immunedeficiency) OR (acquired immune deficiency) OR (acquired immune-deficiency)
5	Epidemiolog* OR Comparative OR ASSESSMENT OR statistics OR numerical OR data OR Evaluation OR meta OR analysis OR multicenter OR mortalit* OR incidence OR surveillance OR prevalence OR morbidit* OR systematic OR burden OR rate OR ratio OR survey OR rar OR cohort OR seroprevalence OR seroincidence OR seroepidemiol* OR screening OR dead OR death* OR decease* OR demise* OR dying OR fatal* OR Nonsurvival* OR survival* OR lethality OR survey OR sentinel OR seroepidemiology OR cohort OR longitudinal OR prospective
6	(#1 AND #2) OR #3
7	#4 AND #5 AND #6
8	LILACS (Americas) (80) IMSEAR (South-East Asia) (18) WPRIM (Western Pacific) (11) AIM (Africa) (3) IMEMR (Eastern Mediterranean) (1)

Table 2: Characteristics of included studies

Authors	Year	Country	Study type	Study period	Cohort/setting	Mean age	Ethnicity	ART coverage	CD4 count/mL (mean/ category)	Viral load copies/mL (mean/ category)	AIDS patients only
Abraham et al.[1]	2013	USA	cohort study	1996–2010	NA-ACCORD	37	white (22%), black (50%), other (28%)	29%	342, 30% (>500)	9120	No
Adjorlolo-Johnson et al.[2]	2010	Côte d'Ivoire	case-control study	1997–1999	—	46.7	—			—	No
Akarolo-Anthony et al.[3]	2014	Nigeria	cohort study	2005–2012	IHVN HIV cohort	33	—	—	—	—	No
Allerdice et al.[4]	2003	Scotland	registry linkage study (population-based)	1981–1996	Scotland's HIV database	28	—	—	—	—	No
Bedimo et al.[5]	2009	USA	cohort study	1997–2004	VACS Virtual Cohort	45.8	white (32%), black (43%), hispanic (8%), others (17%)	—	—	—	No
Carlander et al.[6]	2016	Sweden	cohort study	1993–2011	InfCare HIV, Swedish Population Register (SPR), Swedish National Cervical Screening Register (NKCx)	31	Swedish (28%), sub-Saharan Africa (50%), east (10%), other or unknown (10%)	91%	178, 23% (>500)	—	No
Castilho et al.[7]	2015	Brazil	cohort study	1998–2010	INI cohort	36	white (53%), non-white (47%)	74%	287	31600	No
Chaturvedi et al.[8]	2009	USA	registry linkage study (population-based)	1980–2004	HACM	37	—	—	100, 35.8% (>200)	—	Yes
Chaturvedi et al.[9]	2008	USA	registry linkage study (population-based)	1980–2004	HACM	—	—	—	—	—	Yes
Chen et al.[10]	2015	Taiwan	case-control study	2000–2011	Longitudinal Health Insurance Database (LHID)	—	—	99%	—	—	No
Chen et al.[11]	2014	Taiwan	cohort study	2000–2008	Longitudinal Health Insurance Database (LHID)	31.6	—	42%	—	—	No
Clifford et al.[12]	2005	Switzerland	cohort study	1985–2003	Swiss HIV Cohort Study and Swiss cantonal cancer registries	—	—	26%	—	—	No
Cooksley et al.[13]	1999	USA	registry linkage study	1981–1994	Texas	37	—	—	—	—	No

Authors	Year	Country	Study type	Study period	Cohort/setting	Mean age	Ethnicity	ART coverage	CD4 count/mL (mean/ category)	Viral load copies/mL (mean/ category)	AIDS patients only
			(population-based)								
Dal Maso et al.[14]	2009	Italy	registry linkage study (population-based)	1986–2005	Italian AIDS Registry and 24 Italian cancer registries	—	—	—	—	—	Yes
Engels et al.[15]	2008	USA	registry linkage study (population-based)	1991–2002	HACM	35.8	white (30%), black (53%), hispanic (17%)	—	491	—	No
Engels et al.[16]	2006	USA	registry linkage study (population-based)	1980–2002	HACM	36.2	white (52%), black (30%), hispanic (17%), other (1%)	—	—	—	No
Franceschi et al.[17]	1998	Italy	registry linkage study (population-based)	1986–1992	National Registry of AIDS and 13 Cancer Registries	—	—	—	—	—	Yes
Frisch et al.[18]	2001	USA	registry linkage study (population-based)	1978–1996	HACM	35	white (21%), black (57%), hispanic (21%), other (1%)	—	—	—	Yes
Galceran et al.[19]	2007	Spain	registry linkage study (population-based)	1981–1999	Tarragona and Girona Cancer Registries	—	—		—	—	Yes
Gallagher et al.[20]	2001	USA	registry linkage study (population-based)	1981–1994	New York State Cancer Registry with the combined NYS and New York City AIDS registries	—	non-blacks (55%), blacks (45%) [among cases only]	0%	—	—	Yes
Godbole et al.[21]	2016	India	registry linkage study (population-based)	1991–2009	—	31	—	—	—	—	No
Grabar et al.[22]	2019	France	registry linkage study (hospital-based)	1992–2009	FHDH-ANRS CO4	39	sub-Saharan Africa (15%), outside sub-Saharan Africa (85%)	0%	288	—	No
Hawes et al.[23]	2006	Senegal	cohort study	1994–1998	University of Dakar Infectious Disease Clinic (n = 4349); two sexually transmitted disease clinics in Dakar (n = 773) and in M'Bour (n = 270)	31	—	0%	402, 32% (>500)	17400	No

Authors	Year	Country	Study type	Study period	Cohort/setting	Mean age	Ethnicity	ART coverage	CD4 count/mL (mean/ category)	Viral load copies/mL (mean/ category)	AIDS patients only
Helleberg et al.[24]	2014	Denmark	cohort study	1995–2011	The Danish civil registration system, the Danish cancer registry, the Danish HIV cohort study, the Copenhagen general population study	41	Danish (70%), African (14%), Asian (6%), other (11%)	77%	450	—	No
Hernández-Ramírez et al.[25]	2017	USA	registry linkage study (population-based)	1996–2012	HACM	45	Non-hispanic white (25%), Non-Hispanic black (47%), Hispanic or Latino (28%)	—	—	—	No
Hessol et al.[26]	2004	USA	registry linkage study (population-based)	1994–1995	WIHS cohort	36	African American (54%), Hispanic/Lati— (26.7%), White (16.9%), Other (2.4%)	63%	46.3% (<200), 29.9% (200–350), 30.8% (>350)	52% (>20,000), 28% (<4000)	No
Hleyhel et al.[27]	2013	France	cohort study	1992–2009	FHDH-ANRS CO4	33	Sub-Saharan women (8%) / non-Sub-Saharan (92%)	4%	259, 20% (>500)	—	No
Holmes et al.[28]	2009	Senegal	case-control study	1998–2000	OPD in Pikine (suburb of Dakar); Dantec Hospital at the University of Dakar	48	—	—	—	—	No
Jaquet et al.[29]	2015	Benin, Côte d'Ivoire, Nigeria and Togo	case-control study	2009–2012	Referral hospitals of Abidjan and Cotonou	49	Benin (5.5%), Cote d'Ivore (56.3%), Nigeria (34.0%), Togo (4.2%)	64%	—	—	No
Kadhel et al.[30]	2012	Guadeloupe	registry linkage study (hospital-based)	1999–2006	Guadeloupian HIV Survey Health Centre	37.2	—	63%	31.4% (>500), 43.6% (200-499), 25% (<200)	—	No

Authors	Year	Country	Study type	Study period	Cohort/setting	Mean age	Ethnicity	ART coverage	CD4 count/mL (mean/ category)	Viral load copies/mL (mean/ category)	AIDS patients only
Kahesa et al.[31]	2008	Tanzania	case-control study	2007–2007	Ocean Road Cancer Institute, Dar-es-salaam	50	—	—	—	—	No
Keller et al.[32]	2015	USA	case-control study	1994–2002	WIHS cohort	34	Black (52%), Hispanic (29%), White (16%), other (3%)	16%	25% (<200), 18% (200–349), 24% (350–499), 43% (>500)	44% (<4,000 copies/mL), 23% (4,000–20,000 copies/mL), 33% (>20,000 copies/mL/mL)	No
Khuakoonratt et al.[33]	2008	India	cohort study	2001–2005	Bangkok Metropolitan Administration Medical College and Vajira Hospital	39	—	—	—	—	No
Mahale et al.[34]	2018	USA	registry linkage study (population-based)	1996–2012	HACM: 50+	56	Non-Hispanic white (25.8%), Non-Hispanic black (47.6%), Hispanic (26.6%)	—	—	—	No
Massad et al.[35]	2008	USA	cohort study	1994–2005	WIHS cohort	19.6	Black (47%), Hispanic (43%), White Non-Hispanic and other (9%)	18%	40% (>500), 51% (200–500), 9% (<200)	40% (≤4000), 60% (>4000)	No
Massad et al.[36]	2017	USA	registry linkage study	1994–2015	WIHS cohort	35	Black (49%), Hispanic (33%), Whitne Non-Hispanic/Other (18%)	—	—	—	No
Mayans et al.[37]	1999	Spain	registry linkage study (population-based)	1994–1996	Catalan population-based cancer registry; Catalan AIDS registry	31.6	—	87%	226.3	—	Yes
Mayor et al.[38]	2016	Puerto Rico	registry linkage study (population-based)	1991–2009	Retrovirus Research Center (RCC) HIV cohort, Puerto Rico Central Cancer Registry (PRCCR) data and the Puerto Rican Morality Registry (PRMR)	36.6	Hispanic (100%)	0%	49% (<200)	—	No
Mbulaiteye et al.[39]	2006	Uganda	registry linkage study (population-based)	1988–2002	The AIDS Support Organization (TASO), Kampala Cancer Registry (KCR); Kyadondo County	30	—	—	—	—	No
Moscicki et al.[40]	2004	USA	cohort study	1996–2000	REACH; 13-18 yo girls without HSIL	16.7	African American (75.8%), White and other (24.2%)	—	4.7% (<200), 39.9% (200–500), 55.4% (>500)	73.1% (<10,000)	No

Authors	Year	Country	Study type	Study period	Cohort/setting	Mean age	Ethnicity	ART coverage	CD4 count/mL (mean/ category)	Viral load copies/mL (mean/ category)	AIDS patients only
Mpunga et al.[41]	2018	Rwanda	case-control study	2012–2016	Butaro Cancer Centre of Excellence	41	—	—	—	—	No
Newnham et al.[42]	2005	England	registry linkage study (population-based)	1985–2001	Southeast England	—	—	—	—	—	No
Newton et al.[43]	2001	Uganda	case-control study	1994–1998	Kampala: Mulago (including the Uganda Cancer Institute), Nsambya, Mengo and Rubaga	45	—	—	—	—	No
Phelps et al.[44]	2001	USA	cohort study	1993–1995	HERS and SEER cohort	35	Black (58%), White (24%), Hispanic (16%), native American/Asian and other (2%)	—	443 (only cervical cancer patients)	—	No
Salters et al.[45]	2016	Canada	registry linkage study (population-based)	1994–2008	British Columbia Cancer Agency, British Columbia Centre for Excellence in HIV/AIDS	40	—	100%	150	—	No
Sekirime et al.[46]	2007	Uganda	case-control study	1993–1995	Mulago Hospital, Kampala, Uganda	45	—	—	—	—	No
Selik et al.[47]	1998	USA	registry linkage study	1990–1995	cancer registry (U.S. Bureau of the Census) and HIV registry	—	—	—	—	—	No
Serraino et al.[48]	1999	Italy/France	registry linkage study (population-based)	1988–1998	DMI-2, ISS, San Patrignano Community clinical database	28	—	—	—	—	No
Silverberg et al.[49]	2009	USA	cohort study	1996–2007	Kaisers Permanente Northern and Southern Californian HIV Registry, SEER, California Cancer Registry (CCR)	41	Asian/Pacific (7.2%), Black/African-American (7.5%), Hispanic/Latino (15.2%), White (28.8%), other (0.7%), unknown (40.6%)	27%	388.9	—	No
Silverberg et al.[50]	2018	USA	case-control study	1996–2014	Kaisers Permanente Northern California HIV Registry, Northern California Cancer Registry (CCR)	35.6	Non-Hispanic White (47%), Non-Hispanic Black (8%), Hispanic (20%), other (19%), unknown (5%)	—	—	—	No

Authors	Year	Country	Study type	Study period	Cohort/setting	Mean age	Ethnicity	ART coverage	CD4 count/mL (mean/ category)	Viral load copies/mL (mean/ category)	AIDS patients only
Sitas et al.[51]	1997	South Africa	case-control study	1992–1995	Johannesburg Hospital, Hillbrow Hospital (Johannesburg) and Baragwanath Hospital in Soweto	—	Black (100%)	—	—	—	No
Stein et al.[52]	2008	South Africa	case-control study	1995–2004	Johannesburg Hospital, Hillbrow Hospital (Johannesburg) and Baragwanath Hospital in Soweto	48	—	—	—	—	No
Tanaka et al.[53]	2018	Brazil	registry linkage study (population-based)	1997–2012	Population-based Cancer Registry of Sao Paulo (PBCR-SP), AIDS notification database (SINAN)	—	white (27.8%), black (6.7%), asian (0.4%), pardo (15.2%), Indigineous (0.1%), unknown (49.9%)	—	—	—	Yes
Tanon et al.[54]	2012	Côte d'Ivoire, Benin	cohort study	2009–2011	IeDEA West Africa collaboration, referral hospitals of Abidjan, Côte d'Ivoire and Cotonou, Benin	48	—	—	—	—	No
Thorsteinsson et al.[55]	2016	Denmark	registry linkage study (population-based)	1995–2010	Danish HIV Cohort Study (DHCS), the Danish Pathology Data Bank (DPDB), the Danish Cancer Registry (DCR), the Civil Registration System (CRS)	33.6	White (48.7%), Asian (10.8%), Black (37.7%), other (2.8%), missing (18%)	—	27.9% (<200cells), 27.2% (200–350cells), 44.9% (>350cells)	—	Yes
Uribe Parra et al.[56]	2017	Colombia	registry linkage study (population-based)	1998–2015	CAC population-based cancer registry, Colombian National HIV Registry	—	—	95%	100% (<200cells)	—	No
Vogel et al.[57]	2011	Germany	registry linkage study (pop.-based)	1996–2009	Bonn single centre HIV cohort; Saarland reference population	36	—	40%	359, 35% (<200)	7940	No
Whitham et al.[58]	2017	Senegal	cohort study	1994–2010	two infectious disease, two family planning, and two sexually transmitted disease clinics in or around Dakar.	35	—	31%	406, 25.1% (<200)	—	No
Zhang et al.[59]	2011	China	registry linkage study (hospital-based)	2004–2008	Centre of AIDS prevention and cure of Zhongnan Hospital, Wuhan Cancer Registry	—	—	—	—	—	No
Zohar et al.[60]	2015	Israel	registry linkage study (hospital-based)	1981–2010	National HIV/AIDS Registry (NHAR), Israeli Cancer Registry	35	Jewish (78%), non-Jewish (22%)	0%	—	—	Yes

Table 3: Characteristics of included studies - continued

Authors	Risk measure	Number WLHIV	Number HIV negative women	Comparison group	Follow-up length (years)	Follow-up person years	Outcome	Case definition	Number cases outcome	Included in overall estimate?	Risk of bias
Abraham et al.[1]	SIR	13690	12021	general population	4.5	61605	ICC	ICD-O-3, ICD-9	17	Yes	Low/ moderate
Adjorlolo-Johnson et al.[2]	OR	32	220	HIV negative women	–	–	ICC	1986 International Federation of Gynecology and Obstetrics (FIGO) architectural staging system; histologically confirmed cancer	132	Yes	High
Akarolo-Anthony et al.[3]	SIR	10580	–	general population	–	–	ICC	ICD-O-3	8	Yes	High
Allardice et al.[4]	SIR	619	–	general population	–	4236	ICC	ICD-9	1	No, because of too few cases	High
Bedimo et al.[5]	IRR	–	1429	HIV negative women	5.1	–	ICC	ICD-9-CM	12	Yes	Low/ moderate
Carlander et al.[6]	IR	893	205842	HIV negative women	7.2	2.8 million	CIN2+	Systematized Nomenclature of Medicine (SNOMED)	117	No, because of outcome measure	Low/ moderate
Castilho et al.[7]	SIR	978	–	general population	3.5	–	ICC	–	0	No, because too few cases	High
Chaturvedi et al.[8]	SIR	96303	–	general population	–	–	ICC	ICD-O-3 C530–539	192	No, because of shorter study period than Hernandez et al. (2017)	Low/ moderate
Chaturvedi et al.[9]	SIR	96303	–	general population	–	–	ICC	ICD-O-3 C530–539	101	No, because of shorter study period than Hernandez et al. (2017)	Low/ moderate
Chen et al.[10]	SIR	1115	4460	HIV negative women	4.6	61883	ICC	CD-9-CM 180	4	No, because the cohort is smaller than the cohort in Chen et al. (2014)	Low/ moderate
Chen et al.[11]	SIR	1360	358141	HIV negative women	3.2	4377	ICC	CD-9-CM 180	7	Yes	High
Clifford et al.[12]	SIR	2045	–	general population	3.9	8074	ICC	ICD-O-2 and ICD-10	6	Yes	High
Cooksley et al.[13]	SIR	–	–	general population	–	–	ICC	ICD-O	13	Yes	High

Authors	Risk measure	Number WLHIV	Number HIV negative women	Comparison group	Follow-up length (years)	Follow-up person years	Outcome	Case definition	Number cases outcome	Included in overall estimate?	Risk of bias
Dal Maso et al.[14]	SIR	4891	–	general population	2.3	11062	ICC	ICD-10 C53	30	No, because only AIDS patients were included	Low/ moderate
Engels et al.[15]	SIR	19785	–	general population	3.2	63312	ICC	ICD-O-3	28	No, because of shorter study period than Hernandez et al. (2017)	Low/ moderate
Engels et al.[16]	SIR	60485	–	general population			ICC	ICD-O-3	10	No, because of shorter study period than Hernandez et al. (2017)	Low/ moderate
Franceschi et al.[17]	SIR	1266	–	general population	–	–	ICC	ICD-9 180	1	No, because of shorter study period than Dal Maso et al. (2018)	High
Frisch et al.[18]	RR	48949	–	general population	–	–	ICC	ICD-O-2	46	No, because only AIDS patients were included	Low/ moderate
Galceran et al.[19]	SIR	355	–	general population	6.1	1509	ICC	ICD-10, ICD-O-2	10	No, because only AIDS patients were included	High
Gallagher et al.[20]	SIR	–	–	general population	–	–	ICC	ICD-9	133	No, because only AIDS patients were included	High
Godbole et al.[21]	SIR	11710	–	general population	4	46840	ICC	ICD-9, ICD-10	23	Yes	Low/ moderate
Grabar et al.[22]	SIR	28977	–	general population	–	30223	ICC	ICD9:180.x and ICD10:C53.x	14	Yes (four estimates by the four study periods: 1992–1996, 1997–2000, 2001–2004, 2005–2009)	High
Hawes et al.[23]	HR	165	381	commercial sex workers and women older than 15 years	2.2	1380	HSIL	–	70	No, because of shorter study period than Whithman et al. (2017)	High

Authors	Risk measure	Number WLHIV	Number HIV negative women	Comparison group	Follow-up length (years)	Follow-up person years	Outcome	Case definition	Number cases outcome	Included in overall estimate?	Risk of bias
Helleberg et al.[24]	IRR	820	2600	general population	5.2	4592	ICC	ICD-10 C53	2	No, because of too few cases	High
Hernández-Ramírez et al.[25]	SIR	129995	–	general population	–	893325	ICC	ICD-O	428	Yes	Low/ moderate
Hessol et al.[26]	SIR	1554	396	general population	5.1	7909	ICC	ICD-O-2	1	No, because of shorter study period than Massad et al. (2017)	High
Hleyhel et al.[27]	SIR	11314	–	general population	2.6	29198	ICC	ICD-9, ICD-10	39	No, because no quality check on diagnosis was made as opposed to the study by Grabar et al. (2019) which used the same cohort.	Low/ moderate
Holmes et al.[28]	OR	16	645	Patients from an outpatient department or primary care centre in Dakar	–	–	ICC	cytology; diagnosis identified by biopsy	150	Yes (three estimates by HIV type: HIV-1, HIV-2, HIV-1 and HIV-2)	High
Jaquet et al.[29]	OR	127	864	all adult patients seeking care with a confirmed diagnosis of cancer	–	–	ICC	ICD-O-3	258	Yes	High
Kadhel et al.[30]	SIR	1232	–	general population	6.3	7738	ICC	histologically confirmed cervical lesions (ICC or CIN)	3	No, because too few cases	High
Kahesa et al.[31]	OR	45	231	center attendants and visitors	–	–	ICC	histologically confirmed cancer of the cervix	138	Yes	High

Authors	Risk measure	Number WLHIV	Number HIV negative women	Comparison group	Follow-up length (years)	Follow-up person years	Outcome	Case definition	Number cases outcome	Included in overall estimate?	Risk of bias
Keller et al.[32]	HR	1021	518	general population	5	7650	CIN2+	2001 Bethesda System criteria for cytologic diagnosis, colposycopy	–	No, because of shorter study period than Massad et al. (2017)	Low/ moderate
Khuakoonratt et al.[33]	RR	5	221	women undergoing PAP smear who have LSIL	–	–	ICC	Bethesda criteria	37	No, because of poor data quality; study design seems to be cross-sectional	High
Mahale et al.[34]	SIR	183542	–	–	–	928194	ICC	ICD-O-3	87	No, because only a subgroup of the HACM cohort (women aged 50 years and older) was analysed	Low/ moderate
Massad et al.[35]	RR	45	87	HIV negative women with acknowledged HIV risk behavior	2.6	–	CIN2+; HSIL	Bethesda System for cervicovaginal cytological diagnosis	8	No, because of shorter study period than Massad et al. (2017)	Low/ moderate
Massad et al.[36]	SIR	1807	488	HIV negative women with acknowledged HIV risk behavior	11.8	27176	ICC	Bethesda System for cervicovaginal cytological diagnosis	4	Yes	Low/ moderate
Mayans et al.[37]	IRR	56	–	–	–	–	ICC	–	56	No, because of shorter study period than Galceran et al. (2007)	Low/ moderate
Mayor et al.[38]	SIR	502	–	–	–	–	ICC	ICD-9, ICD-10, ICD-O-3	8	Yes (estimates for the three study periods: 1992–1995, 1996–2002, 2003–2009)	High
Mbulaiteye et al.[39]	SIR	8423	–	–	5	–	ICC	ICD-O-2	27	Yes	High
Moscicki et al.[40]	HR	84	172	HIV negative women without HSIL	2.8	707	HSIL	Bethesda criteria	41	No, because of outcome measure	High
Mpunga et al.[41]	OR	–	–	non-cancer patients	–	–	ICC	ICD-O-3 and ICD-10	560	Yes	High
Newnham et al.[42]	SIR	7110	–	general population	–	31098	ICC	ICD-10	3	No, because of too few cases	High

Authors	Risk measure	Number WLHIV	Number HIV negative women	Comparison group	Follow-up length (years)	Follow-up person years	Outcome	Case definition	Number cases outcome	Included in overall estimate?	Risk of bias
Newton et al.[43]	OR	45	132	non-malignant conditions and cancers not known to be caused by infections	–	–	ICC	Laboratory diagnosis of cancer	65	No	High
Phelps et al.[44]	IRR	871	439	HIV negative women with acknowledged HIV risk behavior	5	6488	ICC	National Death Index Plus (NDI Plus), ICD-9, ICD-10	5	Yes	High
Salters et al.[45]	SIR	2211	–	general population	5.7	12529	ICC	ICD-9, ICD-10	22	Yes	High
Sekirime et al.[46]	OR	33	199	women attending the gynecological or medical outpatient clinics of the same hospital for illnesses other than ICC	–	–	ICC	histologically confirmed diagnosis	116	Yes	High
Selik et al.[47]	RR	NA	–	25–44 year old HIV negative women	6	720000	ICC	ICD-9	12	No, because the study only examines cervical cancer mortality	High
Serraino et al.[48]	SIR	2141	–	general population France and Italy (15–49 years)	4.2	9070	ICC	ICD-9	10	Yes	High
Silverberg et al.[50]	RR	1935	19322	active Kaiser Permanente health plan members (>18 years)	4.9	105000	ICC	All registries follow SEER practices in verifying and coding incident cancers. SEER requirements include categorization of histopathology, invasiveness, tumor size, extension, and lymph node involvement.	8	No, because of shorter study period than Silverberg et al. (2009)	Low/ moderate
Silverberg et al.[49]	OR	115	120175	Non-CIN2+ patients	–	–	CIN2+	Systematized Nomenclature of Medicine	20146	No, because of outcome measure	Low/ moderate
Sitas et al.[51]	OR	–	–	cancer patients with cancer believed not to be of infectious origin	–	–	ICC	ICD-O-2	180	No, because of the selection of controls (patients with cancer believed not to be of infectious origin)	High
Stein et al.[52]	OR	–	–	subjects with other cancer types	–	–	ICC	ICD-O-2 C53	1586	No, because of the selection of controls (patients with cancer	High

Authors	Risk measure	Number WLHIV	Number HIV negative women	Comparison group	Follow-up length (years)	Follow-up person years	Outcome	Case definition	Number cases outcome	Included in overall estimate?	Risk of bias
										believed not to be of infectious origin)	
Tanaka et al.[53]	SIR	–	–	general population	–	142161	ICC	–	114	No, because only AIDS patients	Low/ moderate
Tanon et al.[54]	OR	93	488	HIV negative women part of the IeDEA West Africa collaboration	–	–	ICC	ICD-O-3 C53	153	Yes	High
Thorsteinsson et al.[55]	SIR	1140	17046	HIV negative women of Denmark, matched for age (15 for each WLHIV)	9.1	166356	CIN2+	Systemized Nomenclature of Medicine (SNOMED) codes T8x3* and T83*, 2001 Bethesda criteria, ICD-10 codes C53	407	No, because of outcome measure	Low/ moderate
Uribe Parra et al.[56]	SIR	34076	–	general population			ICC	ICD-10	11	No, because only AIDS patients were included	High
Vogel et al.[57]	SIR	280	–	general population	5.9	8772	ICC	ICD-9 (180, 233.1), ICD-O-3	6	Yes	High
Whitham et al.[58]	SIR	618	702	HIV negative women	2	2640	HSIL	Bethesda criteria	28	No, because of outcome measure	High
Zhang et al.[59]	SIR	4982	–	general population	3.1	4892	ICC	ICD-10	14	Yes	High
Zohar et al.[60]	SIR	3485	–	general population	7	24530	ICC	ICD-O-3	16	No, because no confidence intervals were reported and because the data are questionable	Low/ moderate

Table 4: MOOSE checklist[61]

Item No	Recommendation	Reported on Page No
Reporting of background should include		
1	Problem definition	p.1
2	Hypothesis statement	p.2
3	Description of study outcome(s)	p.2
4	Type of exposure or intervention used	p.2
5	Type of study designs used	p.2
6	Study population	p.2
Reporting of search strategy should include		
7	Qualifications of searchers (eg, librarians and investigators)	Appendix Table 1, p.3
8	Search strategy, including time period included in the synthesis and key words	Appendix Table 1, p.3–6
9	Effort to include all available studies, including contact with authors	No additional contact pursued
10	Databases and registries searched	Appendix Table 1, p.3–6
11	Search software used, name and version, including special features used (eg, explosion)	Not mentioned
12	Use of hand searching (eg, reference lists of obtained articles)	Appendix Figure 1, p.21
13	List of citations located and those excluded, including justification	Appendix Figure 1, p.21
14	Method of addressing articles published in languages other than English	No additional methods
15	Method of handling abstracts and unpublished studies	Appendix Figure 1, p.21
16	Description of any contact with authors	Not applicable
Reporting of methods should include		
17	Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	Appendix Tables 2/3, p.7–18
18	Rationale for the selection and coding of data (eg, sound clinical principles or convenience)	p.2
19	Documentation of how data were classified and coded (eg, multiple raters, blinding and interrater reliability)	p.2
20	Assessment of confounding (eg, comparability of cases and controls in studies where appropriate)	p.4, Figure 2; Appendix Table 3, p.13–18
21	Assessment of study quality, including blinding of quality assessors, stratification or regression on possible predictors of study results	p.3
22	Assessment of heterogeneity	p.3, Figure 1
23	Description of statistical methods (eg, complete description of fixed or random effects models, justification of whether the chosen models account for predictors of study results, dose-response models, or cumulative meta-analysis) in sufficient detail to be replicated	p.3, Appendix p.23–25
24	Provision of appropriate tables and graphics	p.3, Table 1, p.3–6; Figures 1–4; Appendix Tables/Figures
Reporting of results should include		
25	Graphic summarizing individual study estimates and overall estimate	p.3, Figure 1
26	Table giving descriptive information for each study included	Appendix Table 2, p.7–12
27	Results of sensitivity testing (eg, subgroup analysis)	p.4, Figure 2; Appendix Table 11, p.48
28	Indication of statistical uncertainty of findings	p.4, Table 1; p.3–4, Figures 1 and 2
Reporting of discussion should include		
29	Quantitative assessment of bias (eg, publication bias)	p.4, Figure 2; Appendix Figure 2, p.22

30	Justification for exclusion (eg, exclusion of non-English language citations)	Appendix Figure 1, p.21
31	Assessment of quality of included studies	Appendix Table 3, p.13–18
Reporting of conclusions should include		
32	Consideration of alternative explanations for observed results	p.7–8
33	Generalization of the conclusions (ie, appropriate for the data presented and within the domain of the literature review)	p.8
34	Guidelines for future research	p.8
35	Disclosure of funding source	p.3

Figure 1: Flow chart of the search and included studies (29/04/2019)

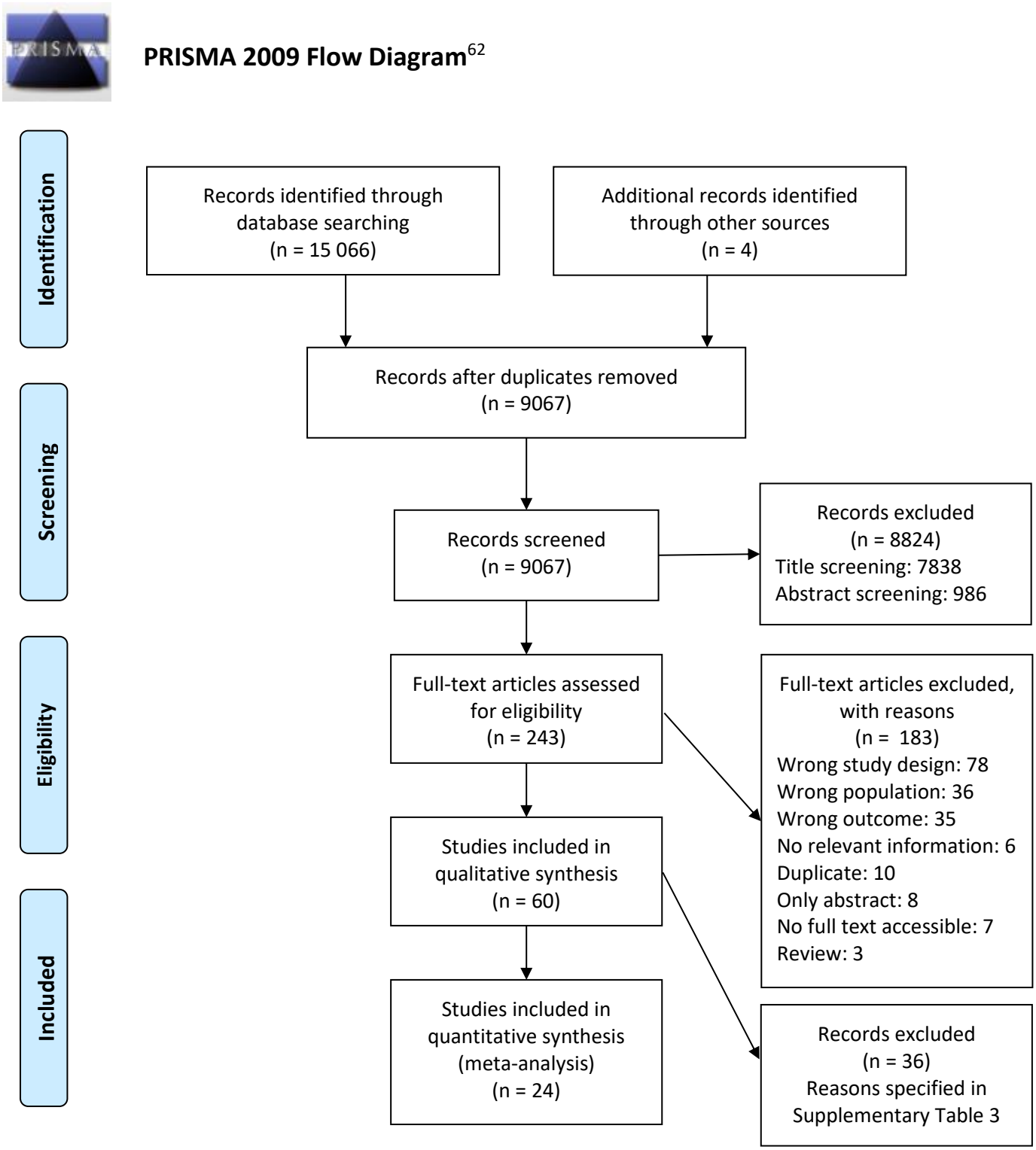
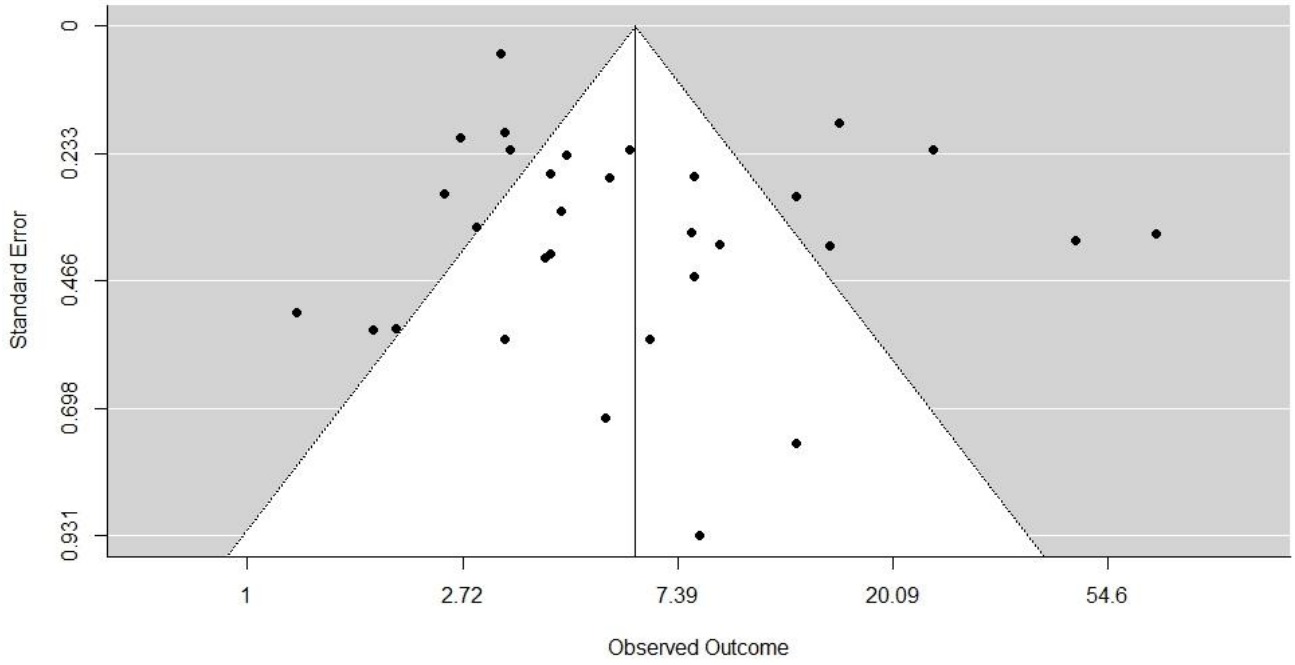


Figure 2: Funnel plot of included studies for the overall estimate



Method for calculating country-specific estimates for cervical cancer attributable to HIV

Step 1
We performed a systematic literature review and meta-analysis to calculate the pooled risk ratio for cervical cancer associated with HIV infection. We anticipated heterogeneity between studies when estimating the risk ratio due to different study designs, methods of analysis and varying adjustment, and geographical and population differences. We therefore used a random effects model to account for both within and between study heterogeneity.

Step 2
At a study level, we explored interaction between ART coverage and risk for cervical cancer among adult females (Supplementary figures 3/4).

Step 3
We used a random-effects model to account for within and between study heterogeneity. We extracted risk ratios for cervical cancer among WLHIV compared to HIV negative women from the relevant studies. The risk ratios were then pooled using a random effects model with the rma function in the metafor package in R.

Step 4
We obtained age-specific HIV prevalence rates (female adults aged 15 years and older) for 2018 for 170 countries from UNAIDS. Similarly, we obtained age-specific (female adults 15+ years) estimates of cervical cancer cases in 2018 from GLOBOCAN for 185 countries. We had both data types for 170 countries.

Step 5
Assumptions:

- We assumed that the pooled risk ratios obtained from a range of registry linkage, cohort and case-control studies were applicable across both low- and middle-income, and high-income countries.
- The degree of adjustment for confounders varied between the primary studies and therefore estimates may be limited by residual confounding.
- No correlation within studies was taken into account (for studies with more than one estimate); the estimates were considered to be independent

Step 6
We estimated the population attributable fraction – including the total numbers and the proportion of WLHIV among new cervical cancer patients – as follows:

$$Population\ Attributable\ Fraction\ (PAF)_c = \frac{HIV\ prevalence_c * (RR - 1)}{1 + HIV\ prevalence_c * (RR - 1)}$$

$$Proportion\ of\ women\ with\ cervical\ cancer\ living\ with\ HIV\ (Proportion)_c$$

$$= \frac{HIV\ prevalence_c * RR}{(1 - HIV\ prevalence_c) + (HIV\ prevalence_c * RR)}$$

c country-specific

Multiplying the *PAF* and the *Proportion* with the total number of cervical cancer cases yielded the total number of cervical cancer cases attributable to HIV and the total number of new cervical cancer patients living with HIV, respectively.

$$N_{\text{cervical cancer cases attributable to HIV}} = PAF_c * N_{\text{cervical cancer cases}}$$

$$N_{\text{cervical cancer patients living with HIV}} = Proportion_c * N_{\text{cervical cancer cases}}$$

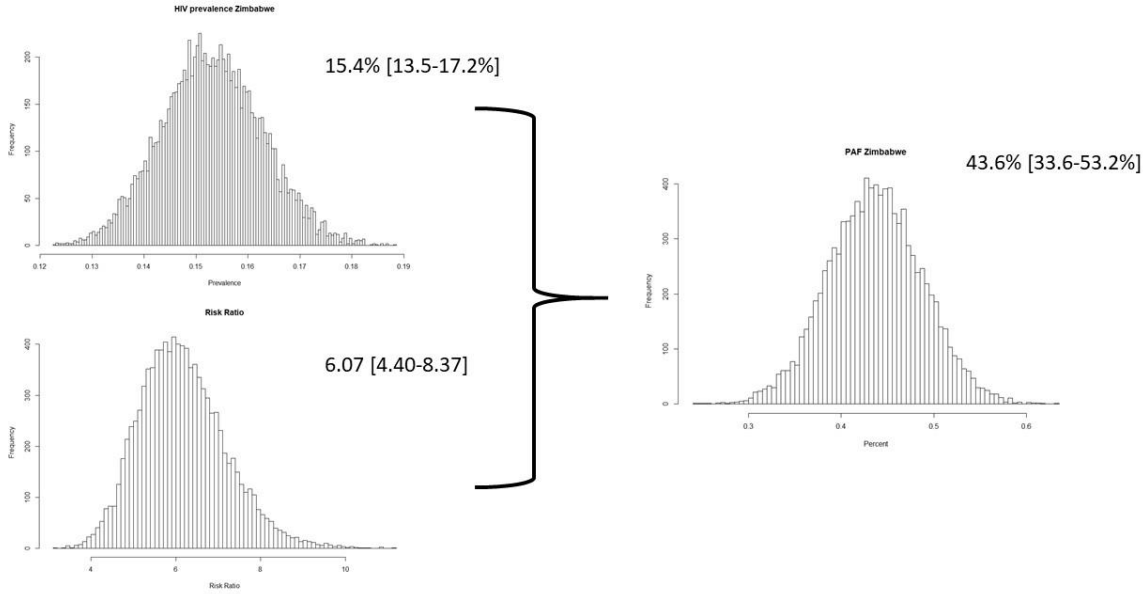
c country-specific

Step 7

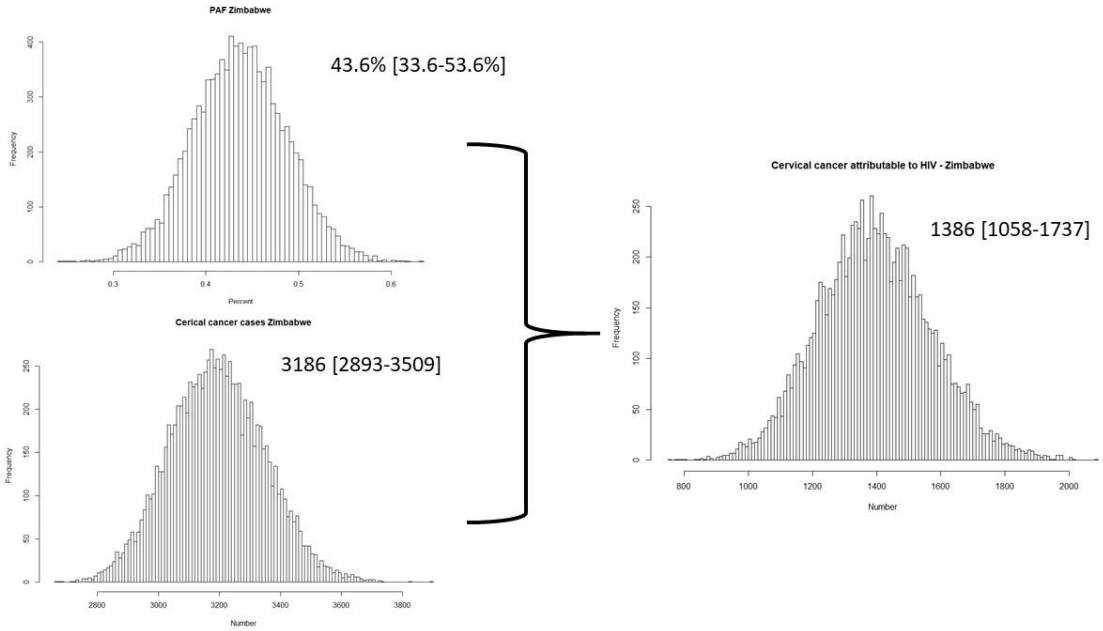
We estimated the uncertainty intervals for cervical cancer cases associated with HIV infection using simulation. We sampled from the probability distributions which captured the uncertainty around the estimate for each component (specifically, log normal for rate ratios, normal for the cervical cancer numbers and beta for the prevalence of HIV infection) calculating the PAF, proportion and numbers for each of 10,000 samples. Total numbers for each country were reported with uncertainty estimates as 95% confidence interval. The uncertainty ranges can be viewed as approximate Bayesian posterior probability limits with very diffuse priors for the estimates and risk factor rate ratios.

Example for Zimbabwe:

The HIV prevalence is represented as 10,000 samples of a variable following a beta distribution (left upper figure). The pooled risk ratio relative risk estimator of interest is presented in the bottom left figure as a histogram of 10 000 samples of a normally distributed variable. Using the above-mentioned formula, we simulated 10 000 samples of the PAF.



In the next step, we simulated the number of cervical cancer cases for Zimbabwe (bottom left figure) and multiplied it with the simulated PAF for Zimbabwe (left upper figure). The result was the number of cervical cancer cases attributable to HIV for Zimbabwe (right figure).



We ran these analyses for all countries and integrated the results into regional and global estimates.

Figure 3. Meta-regression by proportion on antiretroviral therapy

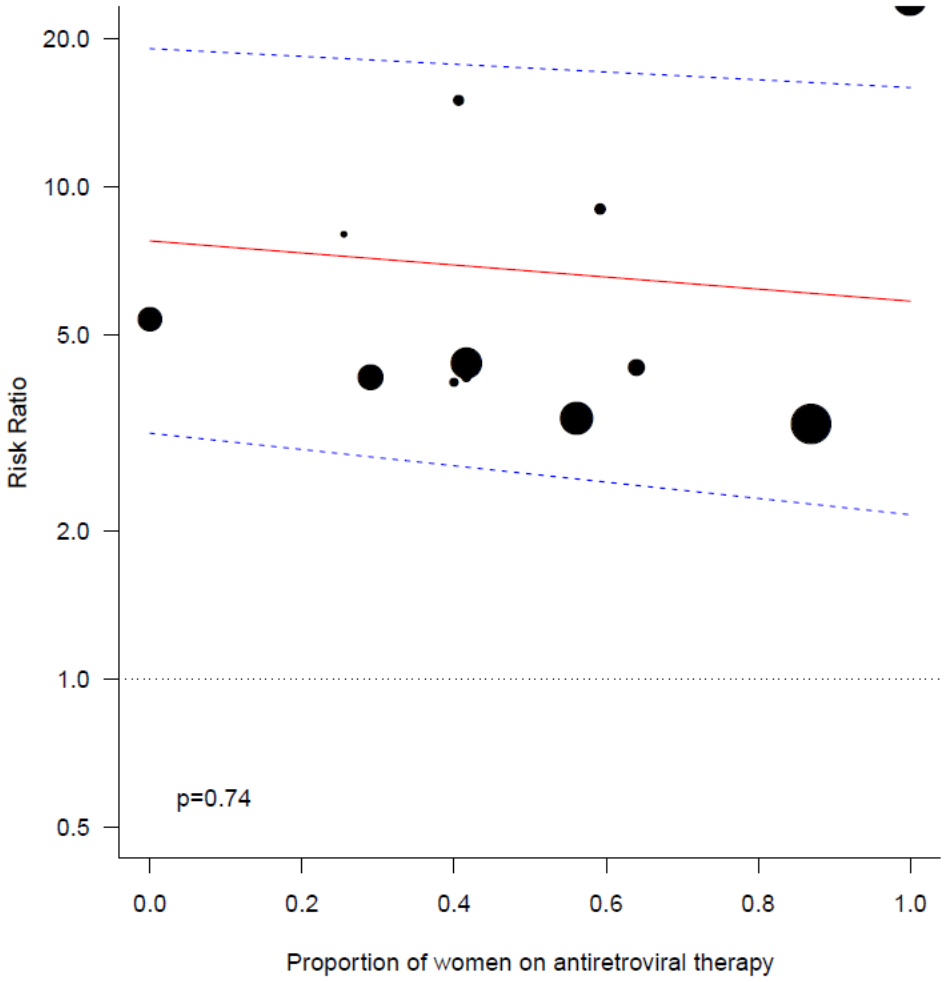


Table 5. Estimated proportion of cervical cancer associated with HIV and PAF to HIV in 2018, by UNAIDS regions

	Region		Number of new cervical cancer cases 2018	HIV prevalence (Females 15 years and older; %)	Proportion of new cervical cancer patients who are living with HIV (%)	Number of new cervical cancer patients living with HIV (2018)	Population attributable fraction for HIV (%)	Number of cervical cancer cases attributable to HIV (2018)
Global			569 847 [545 771–594 985]	0·67 [0·59–0·78]	5·8 [4·6–7·3]	33 000 [26 000–42 000]	4·9 [3·6–6·4]	28 000 [20 000–36 000]
UNAIDS region	Asia and the Pacific	AP	305 603 [285 201–331 333]	0·13 [0·12–0·17]	0·9 [0·6–1·4]	2 900 [2 000–4 200]	0·8 [0·5–1·2]	2 400 [1 500–3 600]
	Caribbean	CAR	4 010 [2 775–6 716]	1·06 [0·91–1·24]	5·8 [4·3–8·0]	230 [170–320]	4·8 [3·3–7·0]	190 [130–280]
	Eastern and southern Africa	ESA	66 958 [56 541–80 087]	8·39 [7·47–9·38]	35·5 [29·1–42·3]	24 000 [20 000–28 000]	29·7 [22·7–36·9]	20 000 [15 000–25 000]
	Eastern Europe and central Asia	EECA	31 855 [29 955–34 124]	0·45 [0·41–0·49]	2·7 [1·9–3·7]	850 [600–1 200]	2·2 [1·5–3·2]	710 [470–1 000]
	Latin America	LA	51 703 [47 159–56 814]	0·25 [0·2–0·31]	1·5 [1·0–2·2]	780 [540–1 100]	1·3 [0·8–1·9]	650 [420–990]
	Middle East and North Africa	MENA	11 164 [8 902–14 322]	0·06 [0·04–0·09]	0·5 [0·3–0·8]	50 [30–90]	0·4 [0·3–0·7]	40 [30–80]
	Western and central Africa	WCA	43 484 [33 335–61 098]	1·81 [1·45–2·26]	10·0 [7·0–13·9]	4 300 [3 000–6 000]	8·3 [5·5–12·1]	3 600 [2 400–5 300]
	Western and central Europe and North America	WCENA	52 732 [48 757–57 246]	0·12 [0·10–0·13]	0·6 [0·5–0·9]	340 [240–480]	0·5 [0·4–0·8]	280 [190–410]

Figure 4: Proportion of women with cervical cancer living with HIV, 2018

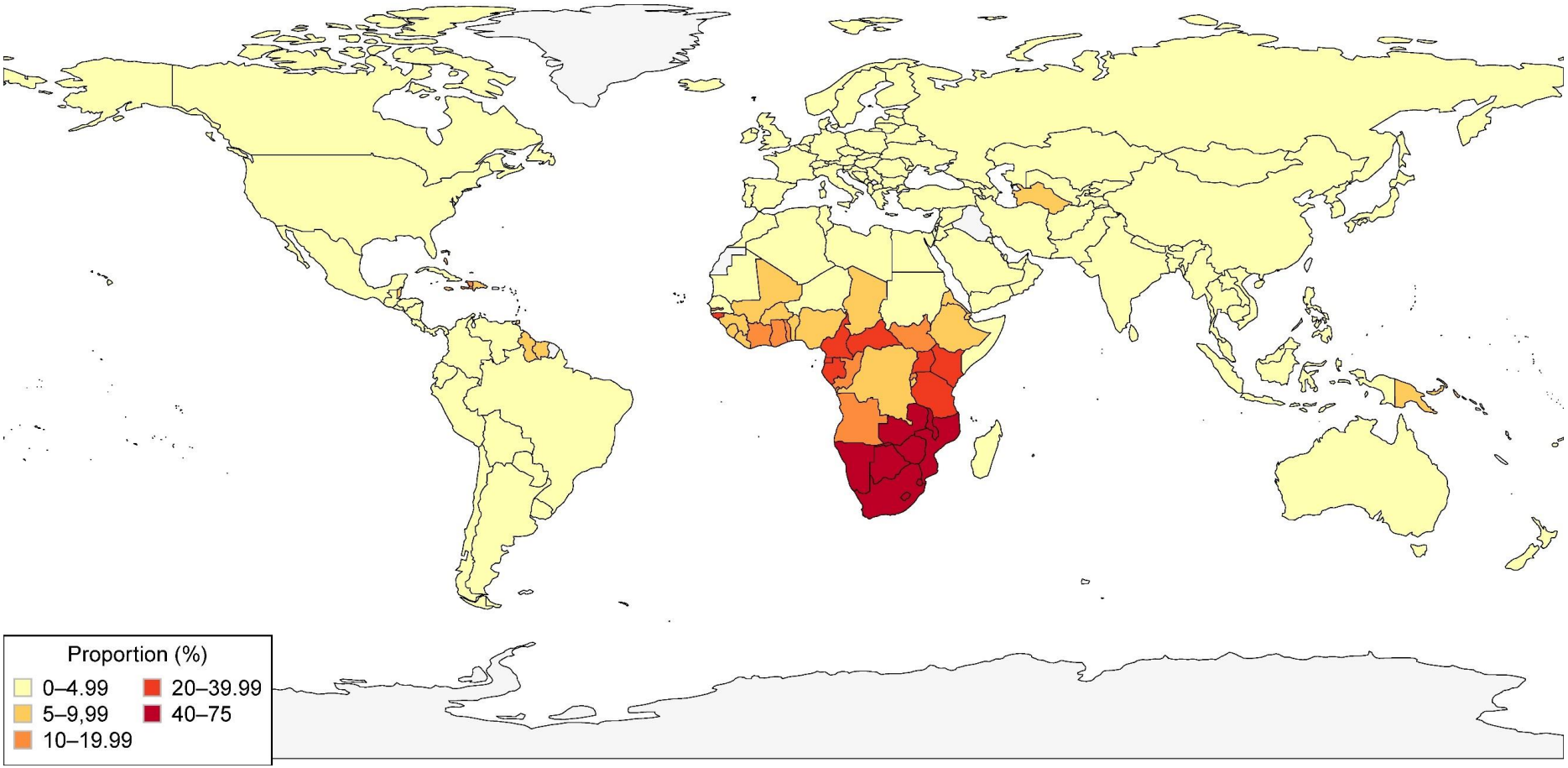


Figure 5: Total number of incident cervical cancer cases among WLHIV

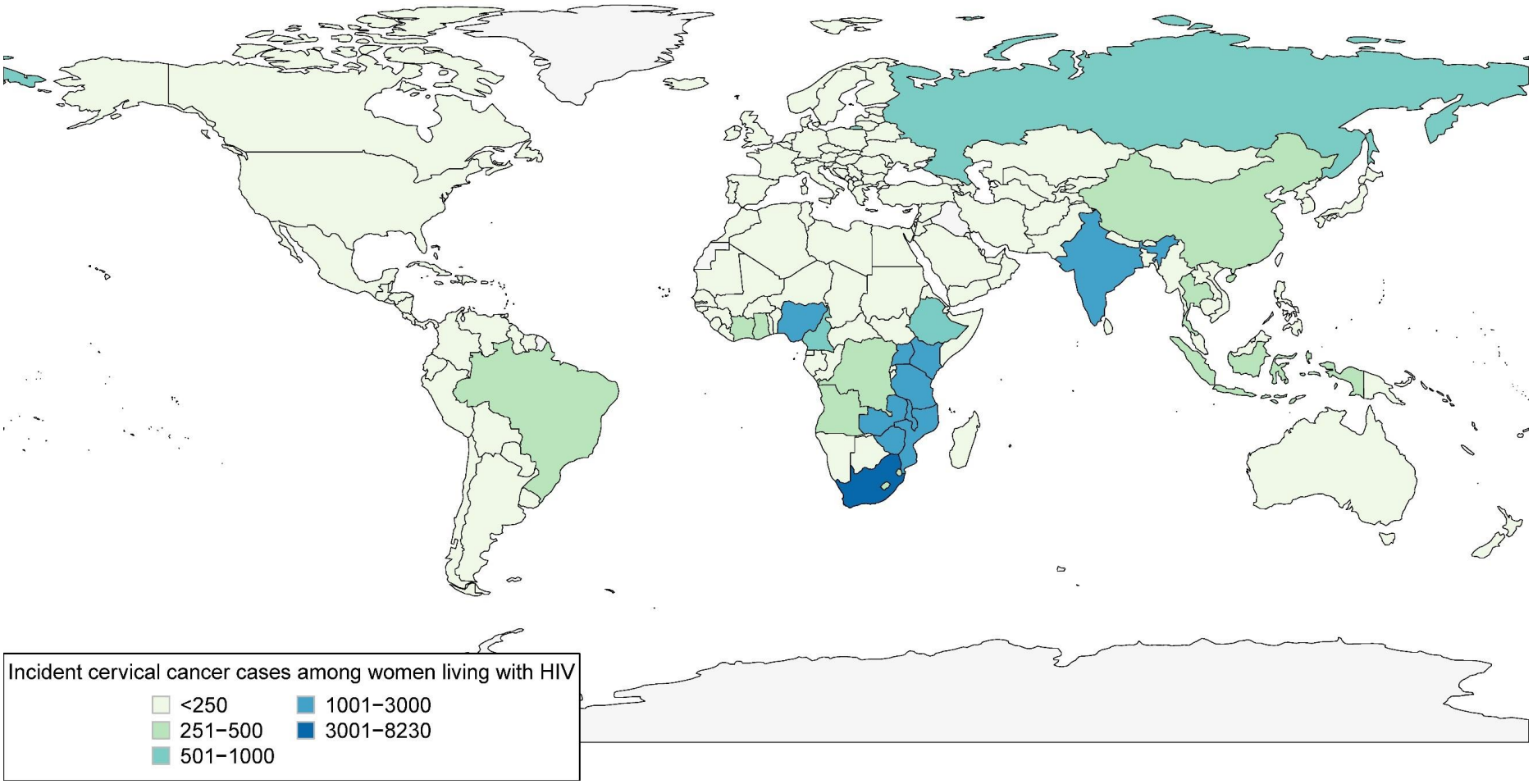


Figure 6: Total number of incident cervical cancer cases attributable to HIV

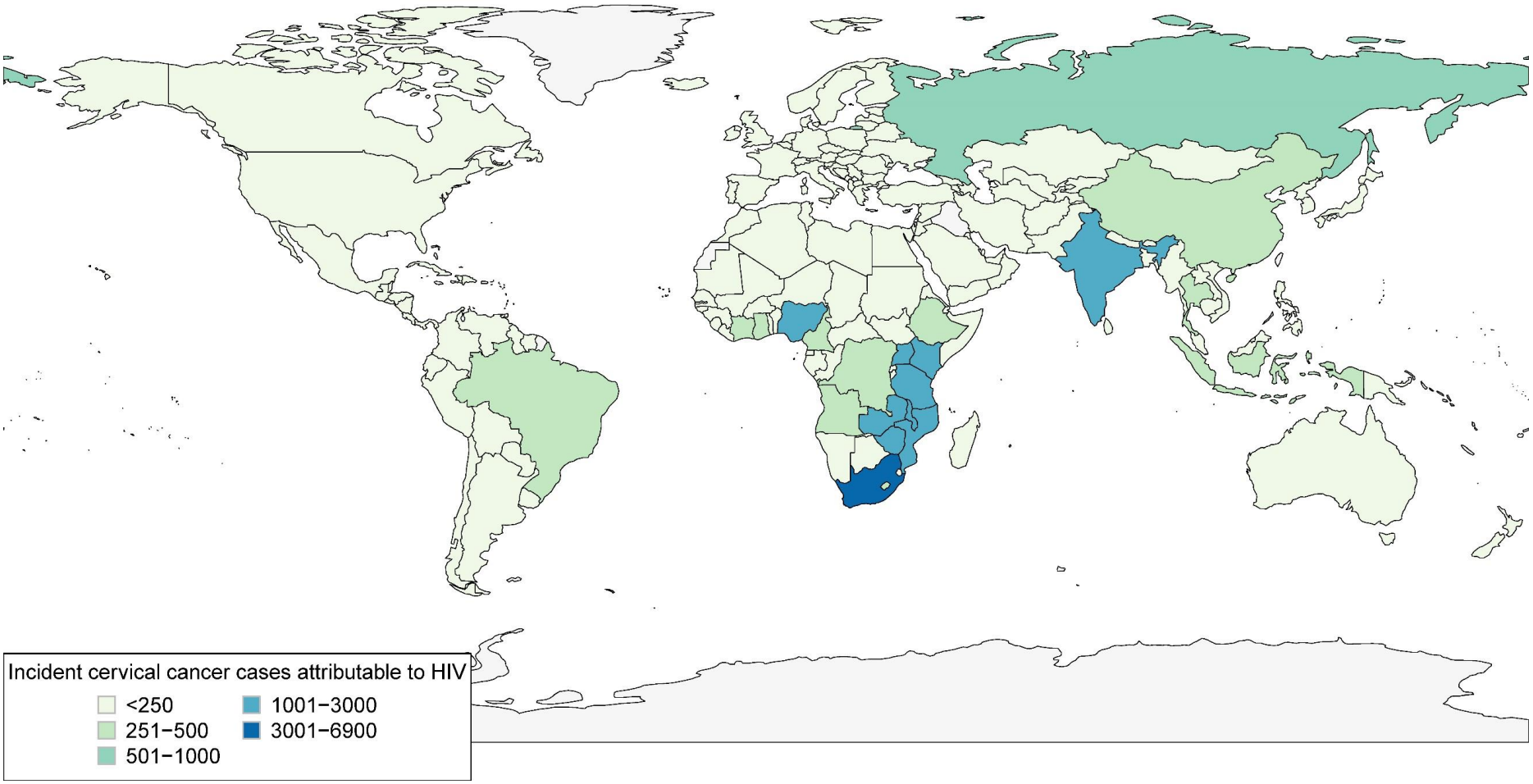


Figure 7: Proportion of women living with HIV among all new cervical cancer patients in 2018, stratified by WHO region

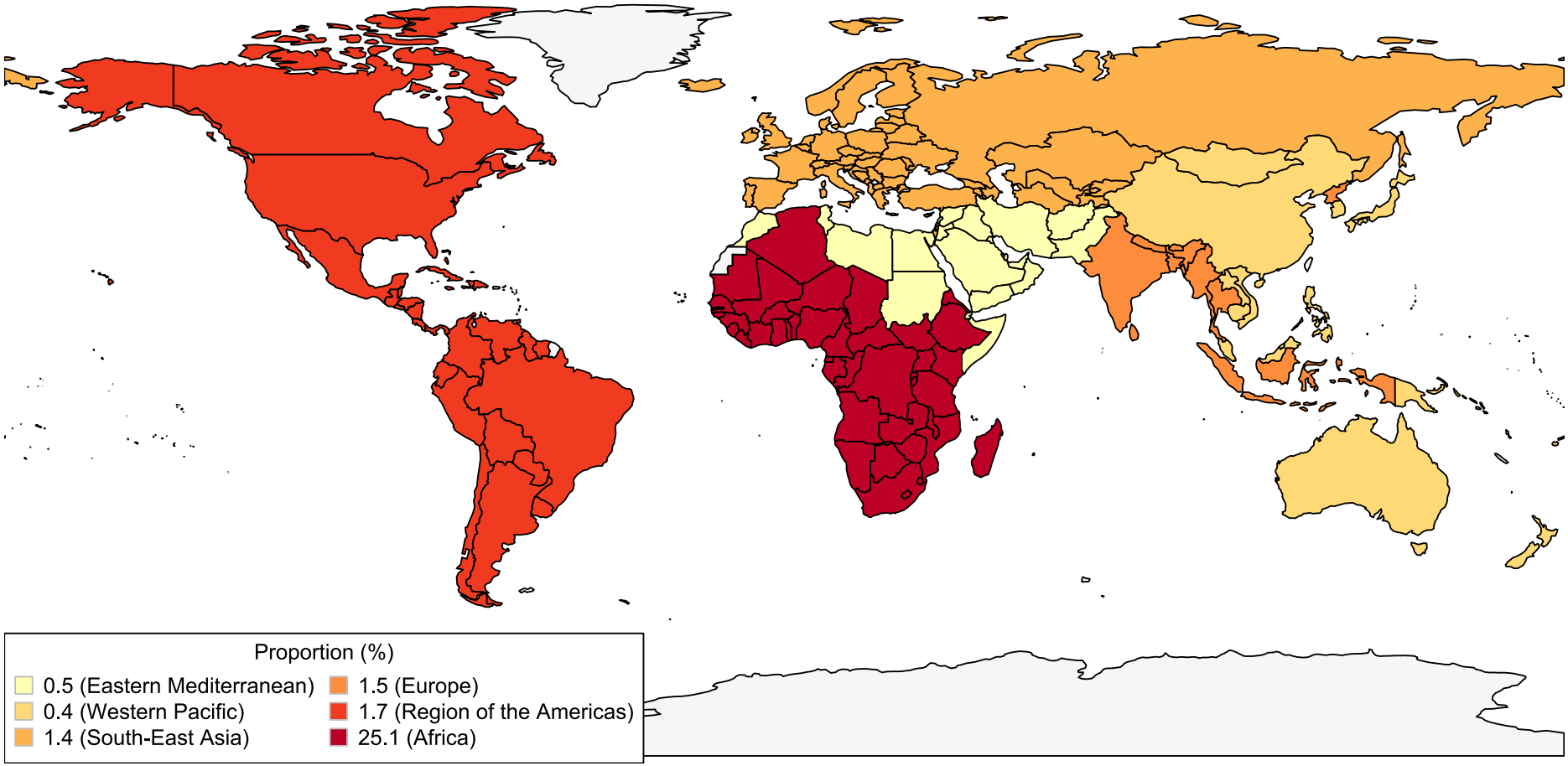


Figure 8: Population attributable fraction for HIV associated with cervical cancer, stratified by WHO region

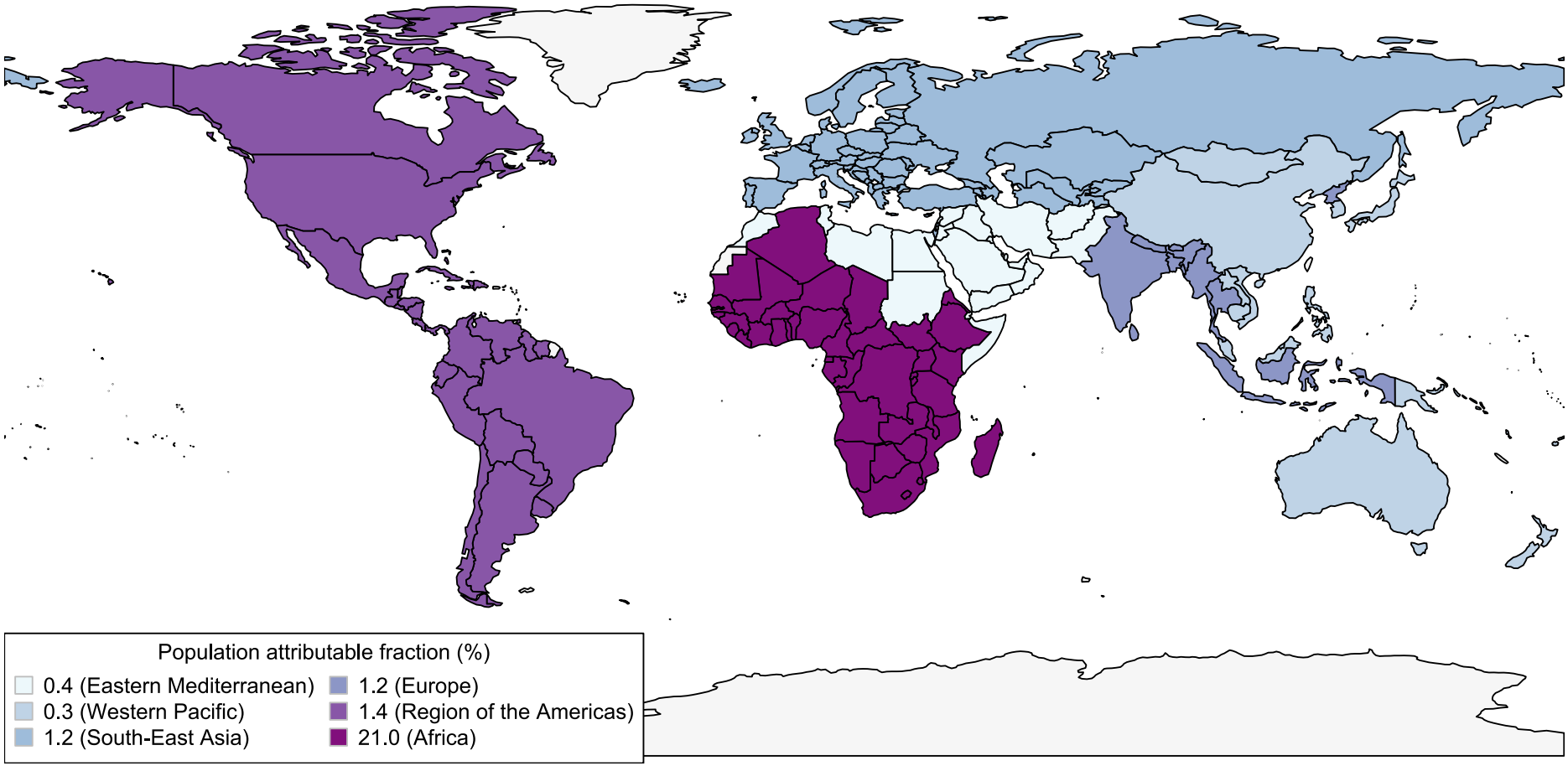


Figure 9: Total number of new cervical cancer cases attributable to HIV in 2018, stratified by WHO region

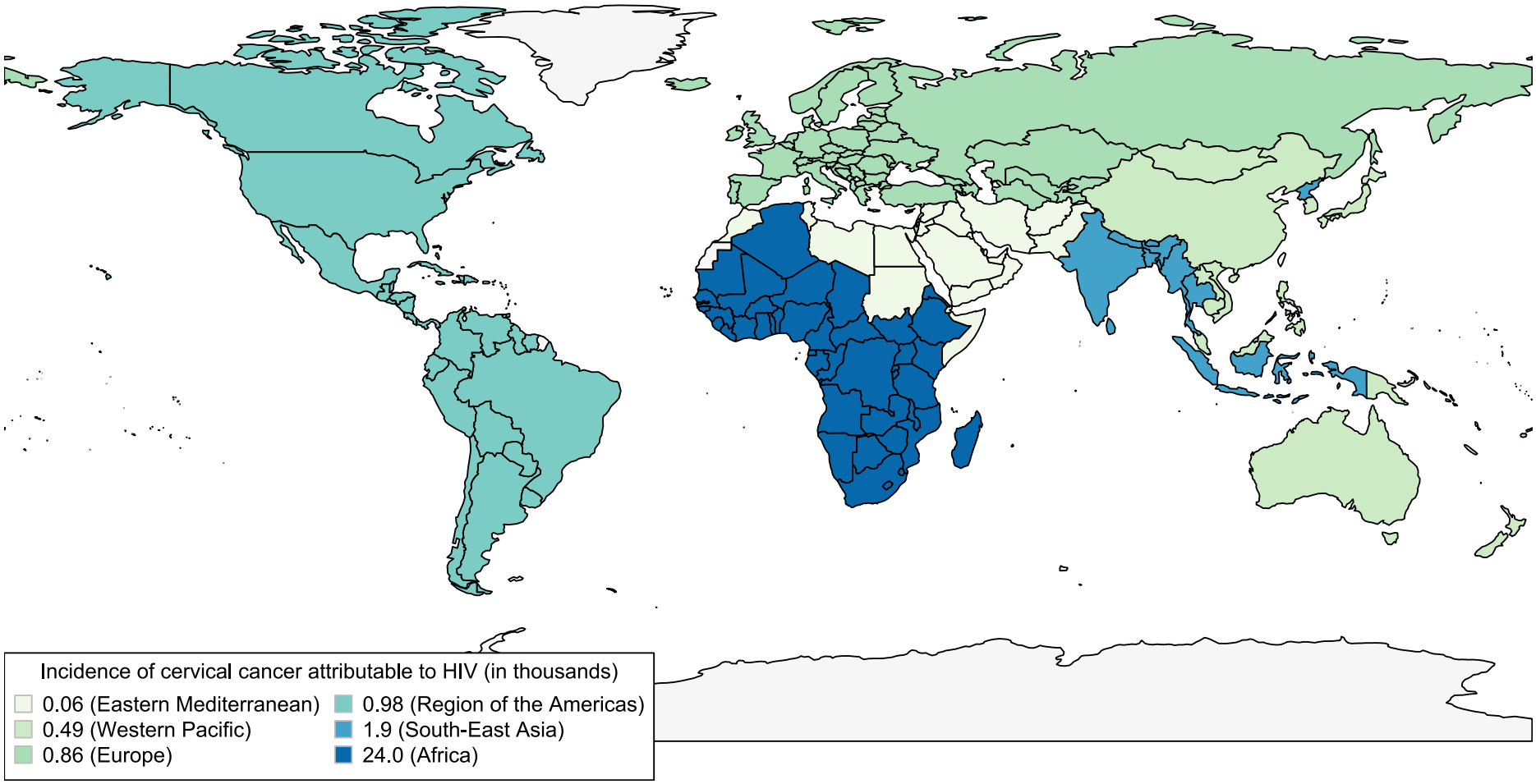


Figure 10: Proportion of women living with HIV among all new cervical cancer patients in 2018, stratified by UNAIDS region

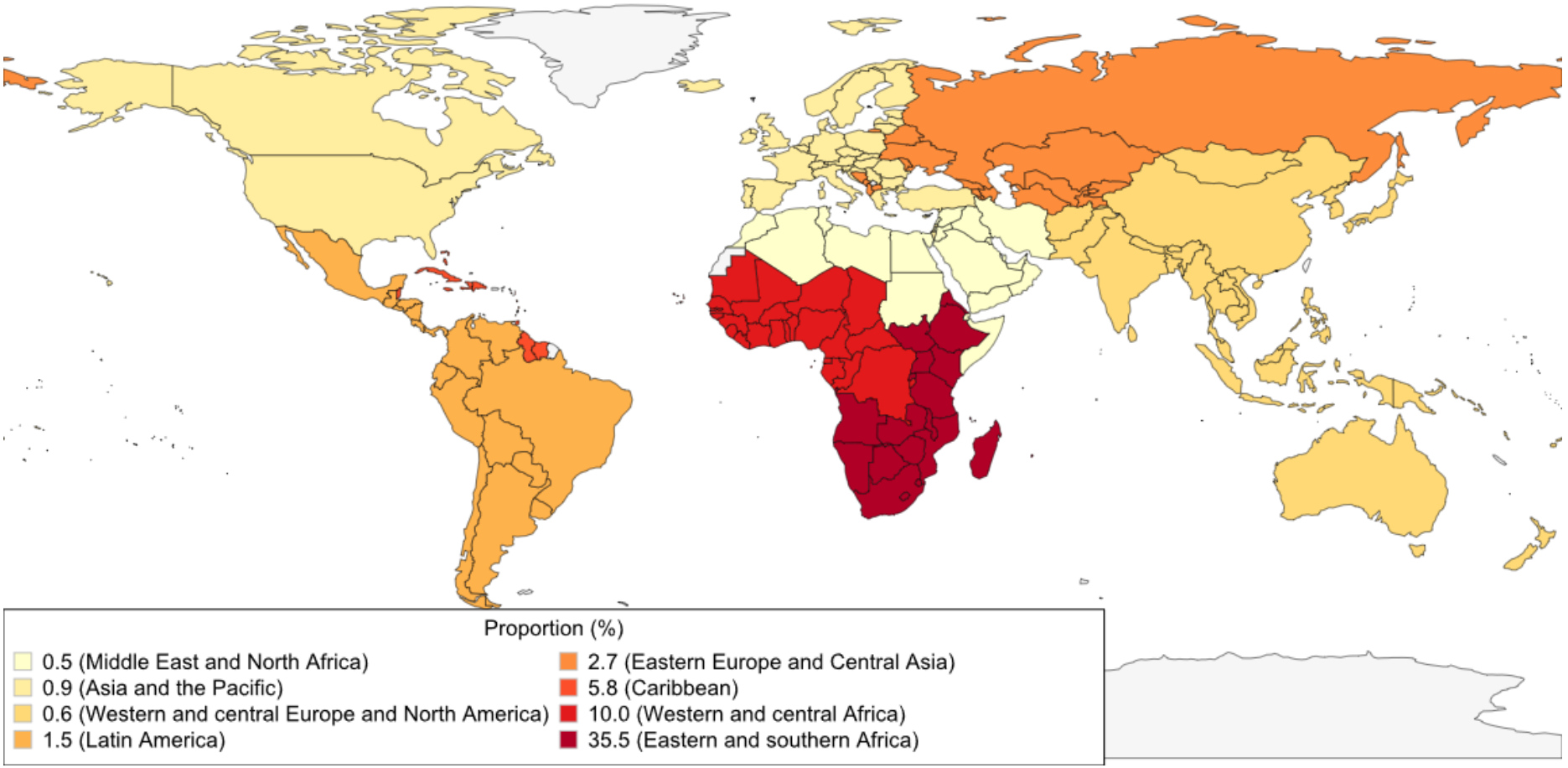


Figure 11: Population attributable fraction for HIV associated with cervical cancer, stratified by UNAIDS region

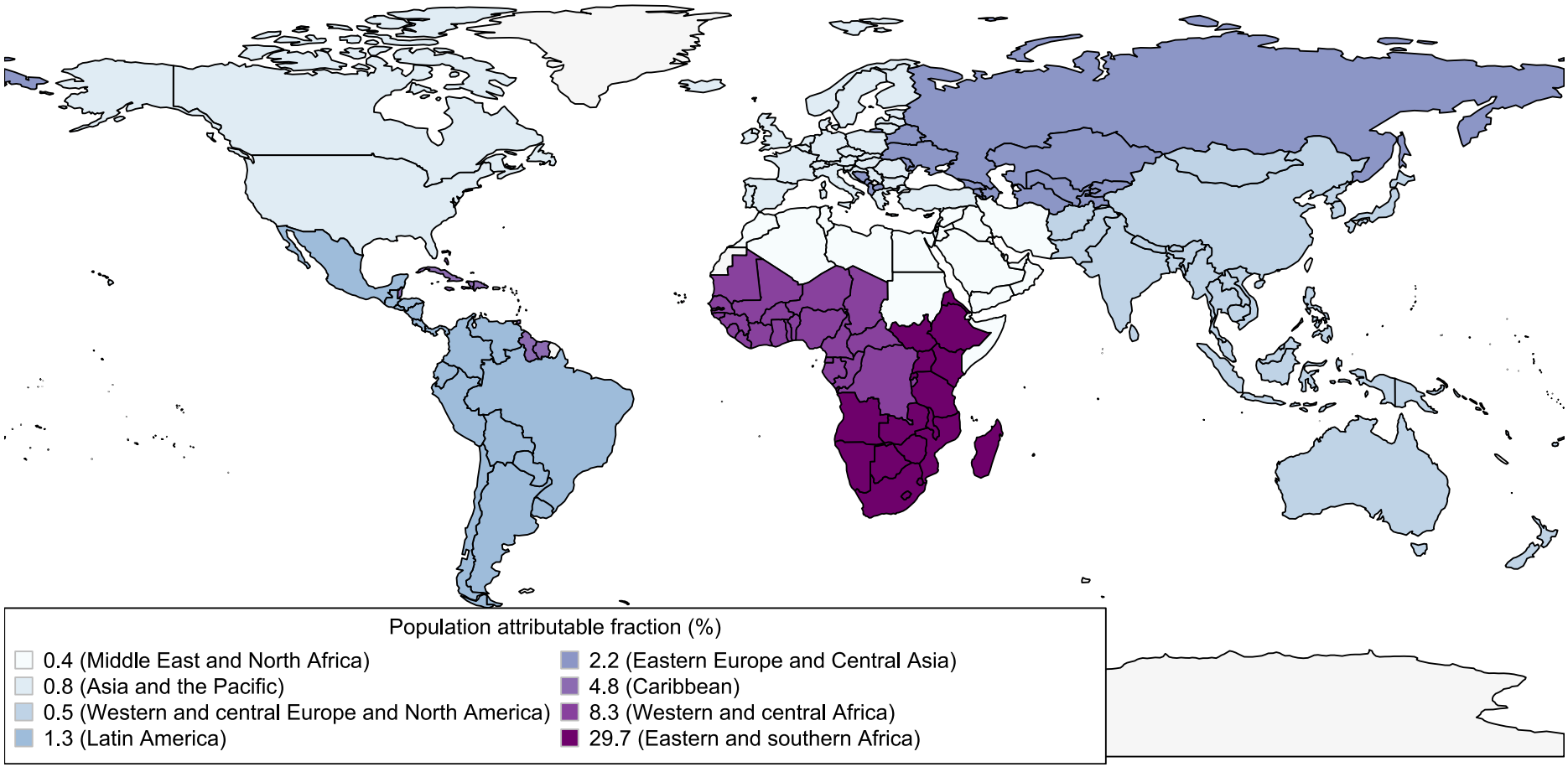


Figure 12: Total number of new cervical cancer cases attributable to HIV in 2018, stratified by UNAIDS regions

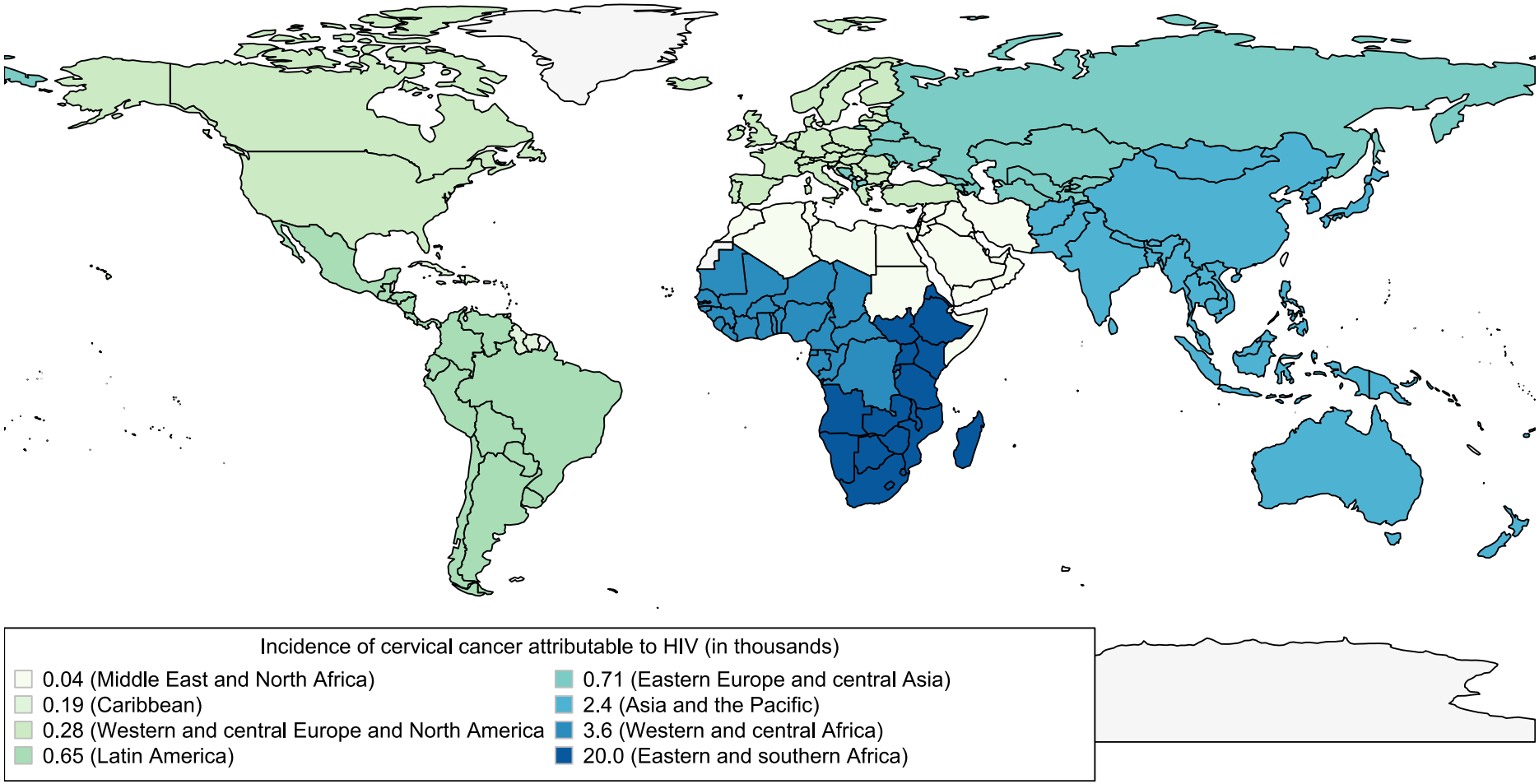


Table 6: Country-level burden of cervical cancer associated with HIV*

Country	Number of new cervical cancer cases 2018	HIV prevalence (Females 15 years and older; %)	Proportion of new cervical cancer patients who are living with HIV (%)	Number of cervical cancer patients living with HIV (2018)	Population attributable fraction for HIV (%)	Number of cervical cancer cases attributable to HIV (2018)
Afghanistan	694 [497–970]	0.02 [0.01–0.03]	0.12 [0.06–0.21]	1 [0–2]	0.1 [0.05–0.18]	1 [0–1]
Albania	134 [89–202]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Algeria	1594 [1402–1812]	0.05 [0.04–0.05]	0.29 [0.21–0.4]	5 [3–6]	0.24 [0.16–0.34]	4 [2–6]
Angola	2949 [2225–3909]	2.53 [2.16–2.96]	13.61 [9.91–18.42]	401 [262–605]	11.41 [7.66–16.02]	335 [208–528]
Argentina	4484 [4068–4943]	0.26 [0.24–0.28]	1.54 [1.1–2.13]	69 [49–96]	1.28 [0.86–1.86]	57 [38–84]
Armenia	196 [124–311]	0.09 [0.08–0.11]	0.57 [0.39–0.82]	1 [1–2]	0.48 [0.31–0.72]	1 [0–2]
Australia	924 [832–1026]	0.03 [0.03–0.04]	0.2 [0.14–0.28]	2 [1–3]	0.16 [0.11–0.24]	2 [1–2]
Austria	390 [314–485]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Azerbaijan	397 [351–449]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Bahamas (the)	29 [16–51]	1.58 [1.4–1.74]	8.77 [6.39–11.95]	3 [1–5]	7.33 [4.97–10.37]	2 [1–4]
Bahrain	19 [11–34]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Bangladesh	8068 [5772–11277]	0.01 [0.01–0.01]	0.05 [0.03–0.07]	4 [2–6]	0.04 [0.03–0.06]	3 [2–5]
Barbados	38 [22–65]	0.85 [0.76–0.94]	4.9 [3.54–6.76]	2 [1–4]	4.1 [2.73–5.91]	2 [1–3]
Belarus	979 [860–1115]	0.28 [0.23–0.36]	1.73 [1.17–2.55]	17 [11–25]	1.44 [0.92–2.2]	14 [9–22]
Belgium	640 [570–718]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Belize	46 [27–79]	1.63 [1.46–1.8]	9.09 [6.65–12.32]	4 [2–8]	7.59 [5.12–10.72]	3 [2–7]
Benin	783 [651–942]	1.25 [0.83–1.99]	7.48 [4.42–11.97]	58 [33–98]	6.27 [3.54–10.32]	49 [27–83]
Bhutan	48 [43–54]	0.15 [0.09–0.3]	1.03 [0.48–1.95]	0 [0–1]	0.86 [0.39–1.67]	0 [0–1]
Bolivia	1949 [1732–2193]	0.18 [0.17–0.19]	1.08 [0.78–1.5]	21 [15–30]	0.9 [0.6–1.3]	18 [11–26]
Bosnia and Herzegovina	556 [474–653]	0 [0–0]	0.02 [0.01–0.03]	0 [0–0]	0.02 [0.01–0.02]	0 [0–0]
Botswana	333 [287–386]	24.89 [23.01–26.38]	66.47 [58.59–73.46]	221 [183–266]	55.51 [45.35–64.41]	184 [144–228]
Brazil	16298 [15319–17340]	0.37 [0.28–0.46]	2.17 [1.45–3.19]	352 [236–522]	1.81 [1.13–2.76]	294 [184–452]
Brunei Darussalam	52 [33–81]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Bulgaria	1080 [954–1222]	0.02 [0.02–0.03]	0.15 [0.1–0.21]	2 [1–2]	0.12 [0.08–0.18]	1 [1–2]

Burkina Faso	2517 [959–6608]	0.94 [0.77–1.12]	5.38 [3.78–7.62]	136 [48–381]	4.49 [2.97–6.66]	113 [40–321]
Burundi	1859 [1214–2846]	1.41 [1.23–1.65]	8.07 [5.8–11.1]	150 [88–257]	6.74 [4.52–9.69]	125 [70–220]
Cabo Verde	50 [29–86]	0.65 [0.55–0.77]	3.83 [2.69–5.45]	2 [1–4]	3.2 [2.11–4.75]	2 [1–3]
Cambodia	993 [555–1776]	0.62 [0.55–0.71]	3.65 [2.61–5.11]	36 [19–71]	3.05 [2.02–4.45]	30 [15–61]
Cameroon	2356 [1878–2955]	4.69 [4.17–5.09]	22.66 [17.21–29.1]	533 [376–752]	18.96 [13.45–25.45]	444 [295–647]
Canada	1434 [1255–1638]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Central African Republic	276 [208–366]	4.21 [3.47–5.21]	21.28 [15.52–28.4]	59 [39–88]	17.76 [12.17–24.63]	49 [30–76]
Chad	742 [560–984]	1.45 [1.14–1.79]	8.12 [5.63–11.58]	60 [38–94]	6.78 [4.41–10.06]	50 [30–82]
Chile	1549 [1301–1845]	0.16 [0.15–0.17]	0.96 [0.69–1.34]	15 [10–22]	0.8 [0.53–1.16]	12 [8–19]
China	106430 [103074–109895]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Colombia	3853 [3421–4340]	0.16 [0.13–0.18]	0.94 [0.66–1.35]	36 [25–53]	0.78 [0.51–1.17]	30 [19–46]
Comoros	141 [92–216]	0.02 [0.01–0.04]	0.13 [0.06–0.25]	0 [0–0]	0.11 [0.05–0.21]	0 [0–0]
Democratic Republic of the Congo	5762 [4347–7638]	1.11 [0.91–1.32]	6.3 [4.45–8.98]	363 [232–571]	5.26 [3.46–7.79]	302 [183–492]
Congo	278 [219–352]	3.53 [2.71–4.68]	18.43 [12.8–25.7]	51 [33–77]	15.33 [10.03–22.27]	43 [26–67]
Costa Rica	351 [263–468]	0.15 [0.14–0.17]	0.91 [0.65–1.27]	3 [2–5]	0.76 [0.5–1.1]	3 [2–4]
Côte d'Ivoire	1789 [1528–2094]	3.58 [2.84–4.54]	18.51 [13.04–25.35]	331 [226–471]	15.48 [10.29–21.96]	277 [179–406]
Croatia	266 [208–341]	0.01 [0.01–0.01]	0.06 [0.04–0.08]	0 [0–0]	0.05 [0.03–0.07]	0 [0–0]
Cuba	1231 [1065–1423]	0.12 [0.09–0.15]	0.69 [0.47–1.03]	9 [6–13]	0.58 [0.36–0.89]	7 [4–11]
Cyprus	45 [30–67]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Czech Republic	813 [711–930]	0.01 [0.01–0.01]	0.07 [0.05–0.09]	1 [0–1]	0.05 [0.04–0.08]	0 [0–1]
Denmark	415 [356–484]	0.07 [0.06–0.08]	0.4 [0.28–0.57]	2 [1–2]	0.34 [0.22–0.49]	1 [1–2]
Djibouti	52 [34–80]	1.36 [1.11–1.71]	7.85 [5.44–11.17]	4 [2–7]	6.54 [4.25–9.66]	3 [2–6]
Dominican Republic	981 [807–1193]	0.86 [0.68–1.12]	5.08 [3.45–7.56]	50 [32–77]	4.26 [2.71–6.4]	42 [25–66]
Ecuador	1612 [1462–1778]	0.21 [0.14–0.34]	1.35 [0.78–2.24]	22 [12–37]	1.12 [0.61–1.92]	18 [10–31]
Egypt	969 [713–1316]	0.02 [0.02–0.02]	0.12 [0.08–0.16]	1 [1–2]	0.1 [0.07–0.14]	1 [1–2]
El Salvador	724 [604–868]	0.36 [0.29–0.42]	2.1 [1.45–3.01]	15 [10–23]	1.75 [1.13–2.63]	13 [8–20]
Equatorial Guinea	100 [75–133]	8.37 [6.72–10.78]	36.3 [27.39–46.25]	36 [24–53]	30.28 [21.43–39.98]	30 [19–45]
Eritrea	218 [142–334]	0.87 [0.66–1.18]	5.15 [3.39–7.64]	11 [6–20]	4.3 [2.69–6.62]	9 [5–17]
Estonia	230 [184–287]	0.45 [0.4–0.5]	2.65 [1.88–3.68]	6 [4–9]	2.21 [1.47–3.21]	5 [3–8]

Eswatini	380 [306–472]	32.92 [31.29–35.02]	75.03 [68.24–80.75]	284 [225–358]	62.61 [52.81–70.81]	237 [181–304]
Ethiopia	6294 [5057–7834]	1.42 [1.09–1.85]	8.12 [5.46–11.84]	510 [322–790]	6.77 [4.32–10.16]	427 [259–680]
Fiji	124 [102–150]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Finland	182 [144–230]	0.05 [0.03–0.06]	0.27 [0.18–0.4]	0 [0–1]	0.23 [0.14–0.35]	0 [0–1]
France	3067 [2836–3317]	0.16 [0.14–0.18]	0.97 [0.68–1.37]	30 [21–42]	0.81 [0.53–1.18]	25 [16–37]
Gabon	156 [125–194]	5.35 [4.29–6.79]	25.87 [18.78–34.23]	40 [27–58]	21.56 [14.95–29.59]	33 [22–49]
Gambia	184 [107–318]	2.4 [1.95–3.13]	13.38 [9.36–18.71]	24 [13–47]	11.15 [7.34–16.36]	20 [10–40]
Georgia	297 [201–439]	0.17 [0.15–0.2]	1.03 [0.72–1.45]	3 [2–5]	0.86 [0.56–1.26]	3 [1–4]
Germany	4608 [4332–4901]	0.05 [0.04–0.05]	0.29 [0.2–0.4]	13 [9–19]	0.24 [0.16–0.35]	11 [7–16]
Ghana	3151 [2803–3542]	2.19 [1.86–2.55]	11.92 [8.56–16.22]	375 [265–524]	9.96 [6.74–14.1]	313 [208–452]
Greece	696 [524–925]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Guatemala	1503 [1300–1737]	0.33 [0.3–0.36]	1.95 [1.4–2.7]	29 [21–42]	1.63 [1.09–2.35]	24 [16–36]
Guinea	1810 [1449–2261]	1.77 [1.49–2.08]	9.84 [7.02–13.58]	178 [119–263]	8.19 [5.45–11.8]	149 [93–230]
Guinea-Bissau	191 [73–502]	4.11 [3.58–4.59]	20.38 [15.34–26.63]	39 [14–108]	17.06 [11.94–23.22]	33 [11–89]
Guyana	124 [99–156]	1.46 [1.29–1.66]	8.26 [5.98–11.25]	10 [7–15]	6.89 [4.66–9.86]	9 [5–13]
Haiti	835 [265–2634]	2.31 [2.07–2.61]	12.63 [9.28–16.96]	105 [33–341]	10.54 [7.17–14.71]	87 [26–293]
Honduras	804 [666–970]	0.27 [0.22–0.32]	1.6 [1.11–2.3]	13 [9–19]	1.33 [0.86–2.01]	11 [7–17]
Hungary	1312 [1125–1531]	0.01 [0.01–0.01]	0.08 [0.05–0.11]	1 [1–1]	0.06 [0.04–0.09]	1 [1–1]
Iceland	15 [9–26]	0.06 [0.06–0.07]	0.37 [0.27–0.52]	0 [0–0]	0.31 [0.21–0.46]	0 [0–0]
India	96922 [93365–100615]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Indonesia	32469 [30005–35135]	0.23 [0.2–0.26]	1.37 [0.97–1.94]	443 [311–638]	1.14 [0.75–1.69]	370 [242–552]
Iran	917 [833–1009]	0.05 [0.03–0.1]	0.34 [0.16–0.63]	3 [1–6]	0.28 [0.13–0.54]	3 [1–5]
Ireland	340 [264–437]	0.13 [0.12–0.14]	0.78 [0.56–1.09]	3 [2–4]	0.65 [0.43–0.94]	2 [1–4]
Israel	241 [196–297]	0.07 [0.06–0.08]	0.43 [0.31–0.6]	1 [1–2]	0.36 [0.24–0.52]	1 [1–1]
Italy	3105 [2903–3321]	0.15 [0.12–0.16]	0.86 [0.61–1.21]	27 [19–38]	0.72 [0.47–1.06]	22 [15–33]
Jamaica	486 [324–729]	1.28 [1.14–1.43]	7.26 [5.27–10]	35 [21–58]	6.06 [4.09–8.68]	29 [17–51]
Japan	13277 [12653–13932]	0 [0–0.01]	0.03 [0.02–0.04]	4 [3–6]	0.03 [0.02–0.04]	3 [2–5]
Jordan	104 [76–142]	0 [0–0]	0.01 [0.01–0.02]	0 [0–0]	0.01 [0.01–0.01]	0 [0–0]
Kazakhstan	1729 [1633–1830]	0.13 [0.12–0.14]	0.76 [0.55–1.05]	13 [9–18]	0.64 [0.42–0.92]	11 [7–16]

Kenya	5250 [4615–5972]	6.21 [5.23–7.48]	28.87 [21.84–36.99]	1516 [1116–1998]	24.17 [17.1–32.29]	1265 [875–1745]
Democratic People's Republic of Korea	1922 [1648–2242]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Republic of Korea	3348 [3165–3541]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Kuwait	59 [42–83]	0.04 [0.03–0.04]	0.23 [0.17–0.33]	0 [0–0]	0.19 [0.13–0.28]	0 [0–0]
Kyrgyzstan	601 [453–798]	0.12 [0.09–0.17]	0.77 [0.5–1.19]	5 [3–8]	0.64 [0.39–1.02]	4 [2–7]
Lao People's Democratic Republic	320 [179–572]	0.21 [0.19–0.23]	1.26 [0.89–1.77]	4 [2–8]	1.05 [0.7–1.53]	3 [2–7]
Latvia	339 [260–442]	0.18 [0.17–0.2]	1.1 [0.79–1.54]	4 [2–6]	0.92 [0.61–1.35]	3 [2–5]
Lebanon	192 [154–239]	0.02 [0.01–0.02]	0.1 [0.07–0.14]	0 [0–0]	0.08 [0.06–0.12]	0 [0–0]
Lesotho	477 [366–621]	27.03 [25.4–28.93]	69.3 [61.65–76.01]	330 [248–440]	57.85 [47.71–66.57]	275 [200–372]
Liberia	548 [209–1439]	1.53 [1.4–1.68]	8.63 [6.32–11.71]	47 [17–130]	7.2 [4.92–10.16]	40 [14–108]
Libya	319 [224–455]	0.11 [0.1–0.12]	0.67 [0.48–0.94]	2 [1–3]	0.56 [0.37–0.82]	2 [1–3]
Lithuania	431 [370–502]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Luxembourg	25 [11–56]	0.13 [0.12–0.15]	0.8 [0.57–1.12]	0 [0–0]	0.67 [0.44–0.98]	0 [0–0]
Madagascar	4353 [2844–6663]	0.15 [0.11–0.21]	0.94 [0.6–1.43]	41 [22–75]	0.78 [0.48–1.24]	34 [18–64]
Malawi	4163 [3500–4952]	11.21 [10.3–11.95]	43.04 [35.12–51.42]	1787 [1373–2298]	35.94 [27.18–44.86]	1492 [1082–1999]
Malaysia	1682 [1551–1825]	0.12 [0.1–0.13]	0.71 [0.5–0.99]	12 [8–17]	0.59 [0.39–0.87]	10 [7–15]
Maldives	41 [29–57]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Mali	2206 [1924–2530]	1.69 [1.35–2.11]	9.49 [6.6–13.39]	209 [142–302]	7.93 [5.15–11.63]	175 [111–262]
Malta	11 [6–21]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Mauritania	481 [183–1263]	0.17 [0.14–0.21]	1.04 [0.71–1.51]	5 [2–14]	0.87 [0.55–1.31]	4 [1–12]
Mauritius	120 [85–169]	0.69 [0.57–0.83]	4.03 [2.8–5.74]	5 [3–8]	3.36 [2.2–4.97]	4 [2–7]
Mexico	7869 [7469–8290]	0.07 [0.06–0.09]	0.45 [0.32–0.64]	35 [25–50]	0.38 [0.25–0.55]	30 [19–44]
Mongolia	370 [327–419]	0.01 [0.01–0.01]	0.06 [0.04–0.08]	0 [0–0]	0.05 [0.03–0.07]	0 [0–0]
Montenegro	54 [29–101]	0.02 [0.02–0.02]	0.11 [0.08–0.16]	0 [0–0]	0.09 [0.06–0.14]	0 [0–0]
Morocco	3388 [3004–3821]	0.06 [0.05–0.08]	0.4 [0.27–0.6]	14 [9–20]	0.33 [0.21–0.51]	11 [7–18]
Mozambique	4291 [3768–4887]	14.23 [11.47–17.42]	50.21 [39.87–60.14]	2151 [1669–2690]	41.91 [31.43–52.23]	1793 [1299–2330]
Myanmar	6472 [3620–11572]	0.42 [0.38–0.48]	2.53 [1.81–3.53]	164 [84–317]	2.12 [1.4–3.06]	136 [67–269]
Namibia	236 [191–292]	14.19 [13.3–15.28]	50.22 [41.86–58.47]	118 [89–154]	41.9 [32.38–51.19]	98 [72–132]
Nepal	2942 [1892–4574]	0.11 [0.09–0.12]	0.64 [0.46–0.91]	19 [11–33]	0.54 [0.36–0.79]	16 [9–29]

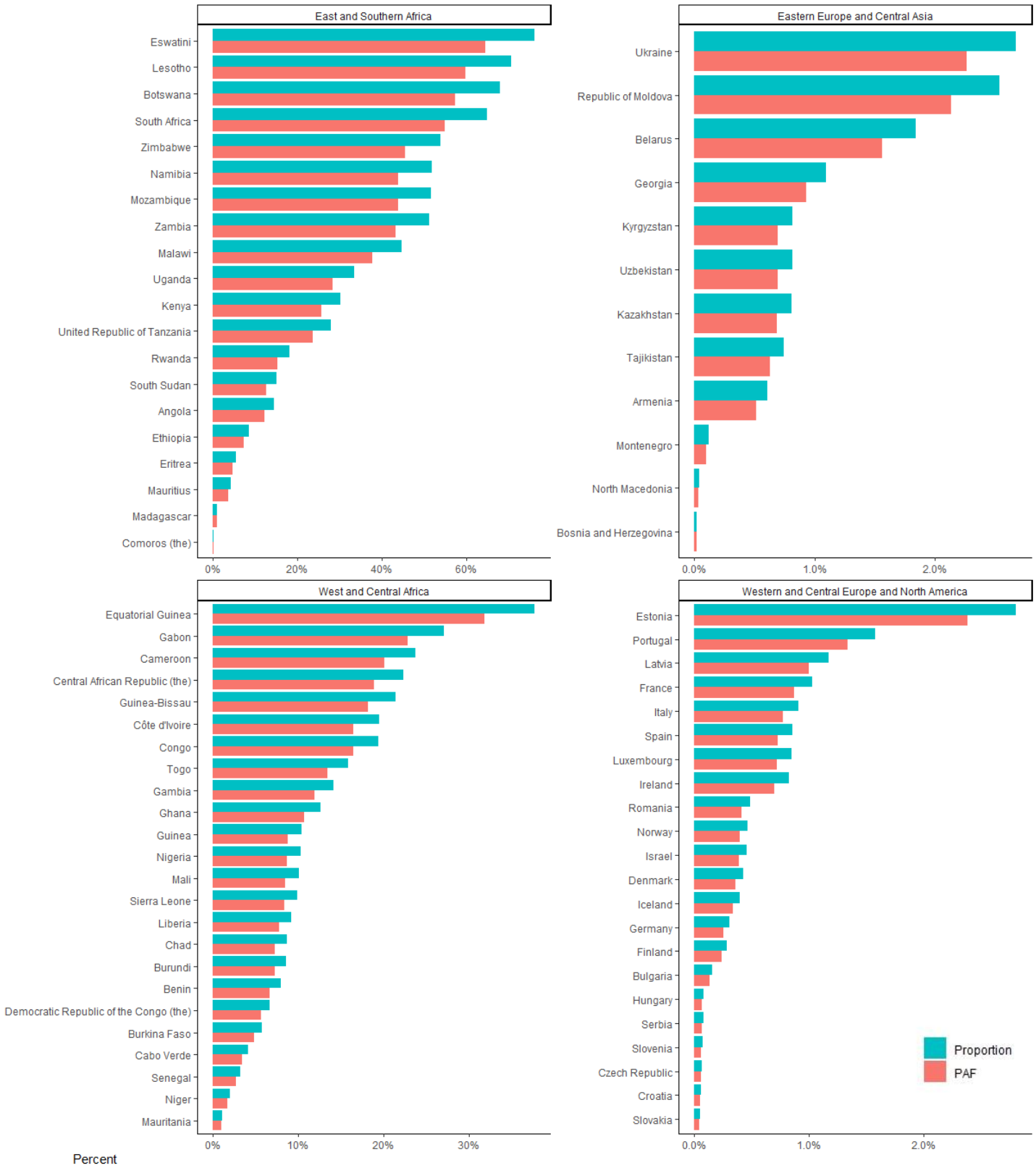
Netherlands	670 [584–769]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
New Zealand	190 [145–250]	0.03 [0.03–0.03]	0.18 [0.13–0.25]	0 [0–1]	0.15 [0.1–0.22]	0 [0–0]
Nicaragua	677 [533–859]	0.13 [0.11–0.17]	0.82 [0.55–1.19]	6 [3–9]	0.68 [0.43–1.03]	5 [3–7]
Niger	543 [336–879]	0.31 [0.26–0.37]	1.85 [1.29–2.66]	10 [5–19]	1.55 [1–2.3]	8 [4–16]
Nigeria	14943 [12946–17249]	1.72 [1.29–2.29]	9.67 [6.42–14.03]	1445 [941–2154]	8.07 [5.03–12.16]	1203 [737–1868]
Norway	361 [305–428]	0.07 [0.07–0.08]	0.44 [0.31–0.61]	2 [1–2]	0.37 [0.24–0.53]	1 [1–2]
Oman	77 [52–114]	0.09 [0.08–0.1]	0.56 [0.4–0.78]	0 [0–1]	0.46 [0.31–0.68]	0 [0–1]
Pakistan	5601 [4538–6913]	0.07 [0.07–0.08]	0.45 [0.32–0.63]	25 [17–37]	0.38 [0.24–0.55]	21 [13–32]
Panama	432 [334–559]	0.52 [0.47–0.57]	3.08 [2.22–4.22]	13 [9–20]	2.57 [1.72–3.69]	11 [7–17]
Papua New Guinea	1024 [890–1178]	0.91 [0.83–1]	5.28 [3.83–7.26]	54 [38–77]	4.4 [2.95–6.31]	45 [29–67]
Paraguay	1033 [842–1267]	0.27 [0.2–0.37]	1.67 [1.08–2.55]	17 [11–28]	1.39 [0.85–2.2]	14 [8–24]
Peru	4103 [3776–4459]	0.15 [0.11–0.21]	0.94 [0.59–1.45]	39 [24–60]	0.78 [0.46–1.27]	32 [19–52]
Philippines	7190 [6784–7620]	0.01 [0.01–0.01]	0.08 [0.05–0.11]	6 [4–8]	0.06 [0.04–0.1]	5 [3–7]
Poland	3220 [2994–3463]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Portugal	750 [684–822]	0.25 [0.22–0.28]	1.49 [1.06–2.08]	11 [8–16]	1.24 [0.82–1.8]	9 [6–14]
Qatar	19 [13–27]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Republic of Moldova	639 [509–802]	0.39 [0.31–0.5]	2.37 [1.6–3.49]	15 [10–24]	1.98 [1.26–3.02]	13 [8–20]
Romania	3308 [3156–3468]	0.08 [0.07–0.08]	0.46 [0.33–0.64]	15 [11–21]	0.38 [0.25–0.55]	13 [8–18]
Russian Federation	18164 [17728–18611]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Rwanda	1304 [969–1756]	3.32 [2.95–3.69]	17.16 [12.82–22.63]	224 [149–335]	14.33 [9.9–19.74]	187 [117–290]
Saudi Arabia	316 [186–537]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Senegal	1876 [715–4925]	0.52 [0.45–0.59]	3.05 [2.17–4.29]	58 [20–159]	2.55 [1.69–3.73]	48 [17–134]
Serbia	1327 [1205–1461]	0.01 [0.01–0.02]	0.07 [0.05–0.11]	1 [1–2]	0.06 [0.04–0.1]	1 [0–1]
Sierra Leone	299 [275–325]	1.69 [1.35–2.06]	9.37 [6.51–13.12]	28 [19–40]	7.83 [5.15–11.5]	23 [15–35]
Singapore	429 [282–652]	0.04 [0.04–0.05]	0.26 [0.19–0.37]	1 [1–2]	0.22 [0.14–0.32]	1 [1–2]
Slovakia	692 [635–755]	0.01 [0.01–0.01]	0.05 [0.03–0.08]	0 [0–1]	0.04 [0.02–0.07]	0 [0–0]
Slovenia	110 [74–164]	0.01 [0.01–0.02]	0.07 [0.04–0.1]	0 [0–0]	0.06 [0.03–0.09]	0 [0–0]
Somalia	989 [646–1514]	0.14 [0.1–0.2]	0.86 [0.54–1.34]	8 [5–16]	0.72 [0.43–1.18]	7 [4–14]
South Africa	12983 [12221–13793]	22.39 [20.63–23.89]	63.35 [55.18–70.74]	8223 [7087–9316]	52.93 [42.75–61.94]	6866 [5511–8147]

South Sudan	1101 [719–1685]	2.75 [2.01–3.46]	14.28 [9.66–20.1]	157 [88–272]	11.83 [7.69–17.52]	130 [72–233]
Spain	1942 [1751–2154]	0.13 [0.12–0.15]	0.81 [0.58–1.12]	16 [11–22]	0.67 [0.45–0.98]	13 [9–19]
Sri Lanka	1136 [1051–1228]	0.01 [0.01–0.01]	0.07 [0.05–0.1]	1 [1–1]	0.06 [0.04–0.09]	1 [0–1]
Sudan	1084 [751–1565]	0.21 [0.09–0.39]	1.23 [0.52–2.55]	13 [5–30]	1.01 [0.42–2.15]	11 [4–26]
Suriname	85 [57–126]	1.13 [0.75–1.63]	6.48 [3.93–10.17]	5 [3–10]	5.39 [3.15–8.81]	5 [2–9]
Sweden	558 [496–628]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Switzerland	258 [225–296]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Syrian Arab Republic	259 [123–545]	0 [0–0]	0.02 [0.01–0.03]	0 [0–0]	0.02 [0.01–0.02]	0 [0–0]
Tajikistan	220 [157–308]	0.11 [0.1–0.14]	0.69 [0.48–1]	2 [1–3]	0.58 [0.37–0.87]	1 [1–2]
Tanzania	9772 [8065–11841]	5.7 [5.17–6.21]	26.73 [20.6–33.79]	2611 [1900–3520]	22.29 [16.01–29.4]	2177 [1478–3067]
Thailand	8622 [8246–9015]	0.72 [0.62–0.83]	4.19 [2.99–5.89]	361 [257–509]	3.51 [2.32–5.1]	303 [199–440]
North Macedonia	151 [107–214]	0.01 [0.01–0.01]	0.04 [0.03–0.05]	0 [0–0]	0.03 [0.02–0.05]	0 [0–0]
Timor-Leste	50 [28–89]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Togo	568 [516–625]	2.83 [2.62–3.06]	15.02 [11.24–19.9]	85 [63–115]	12.55 [8.69–17.28]	71 [49–99]
Trinidad and Tobago	140 [86–229]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Tunisia	285 [229–355]	0.02 [0.01–0.03]	0.12 [0.07–0.2]	0 [0–1]	0.1 [0.06–0.17]	0 [0–1]
Turkey	2356 [2125–2612]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Turkmenistan	397 [298–528]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Uganda	6413 [5607–7334]	7.14 [6.67–7.8]	32.05 [25.2–39.6]	2052 [1564–2642]	26.74 [19.49–34.68]	1715 [1222–2302]
Ukraine	5733 [5450–6030]	0.42 [0.39–0.46]	2.52 [1.81–3.47]	144 [103–200]	2.1 [1.41–3.02]	120 [81–173]
United Arab Emirates	108 [89–132]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
United Kingdom	3430 [3237–3634]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
USA	14065 [13724–14414]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Uruguay	288 [231–359]	0.28 [0.21–0.37]	1.67 [1.08–2.54]	5 [3–8]	1.39 [0.85–2.2]	4 [2–7]
Uzbekistan	1608 [1492–1733]	0.13 [0.12–0.14]	0.77 [0.55–1.07]	12 [9–17]	0.64 [0.43–0.93]	10 [7–15]
Venezuela	4174 [3838–4539]	… […–…]	… […–…]	… […–…]	… […–…]	… […–…]
Viet Nam	4177 [3834–4551]	0.2 [0.17–0.22]	1.17 [0.83–1.65]	49 [34–70]	0.98 [0.65–1.44]	41 [27–61]
Yemen	170 [115–251]	0.03 [0.02–0.04]	0.17 [0.09–0.28]	0 [0–1]	0.14 [0.07–0.25]	0 [0–0]
Zambia	2994 [2589–3462]	13.85 [12.27–15.73]	49.57 [40.75–58.15]	1481 [1165–1848]	41.32 [31.68–50.9]	1234 [913–1586]

Zimbabwe	3186 [2893–3509]	15.36 [13.47–17.22]	52.19 [43.47–60.94]	1660 [1350–1996]	43.58 [33.62–53.2]	1386 [1058–1737]

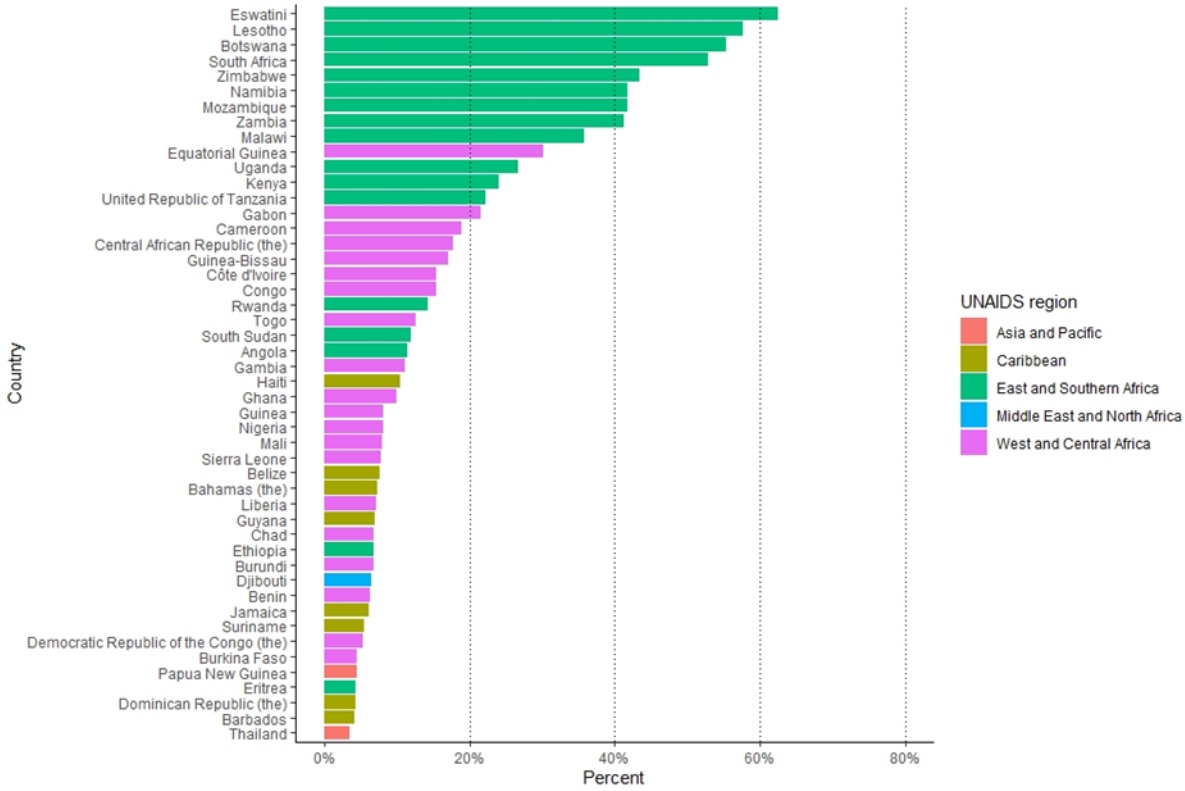
* Countries with suppressed UNAIDS HIV estimates were labelled … […–…] for all estimates derived from HIV prevalence.

Figure 13. Estimated proportion and population attributable fraction for HIV associated cervical cancer, ranked by burden proportion from highest to lowest, according to UNAIDS region



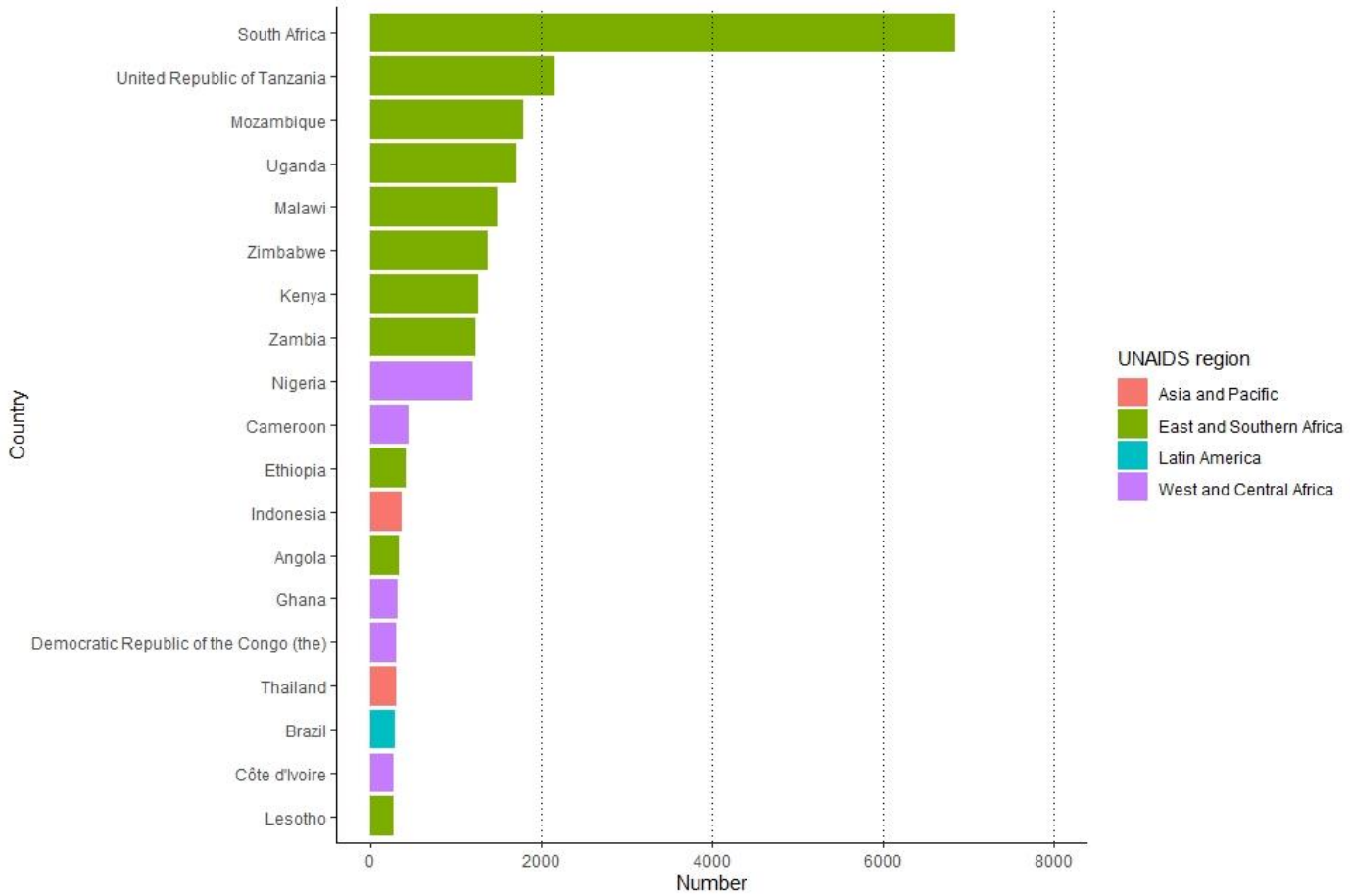
Proportion: Proportion of cervical cancer patients living with HIV
PAF: Proportion of cervical cancer cases attributable to HIV

Figure 14. Estimated population attributable fraction for cervical cancer and HIV, ranked from highest to lowest proportion, restricted to 50 highest ranked countries (by UNAIDS region)⸸



⸸ Turkmenistan (Eastern Europe and Central Asia; 5–9.99%), and Trinidad and Tobago (Caribbean; <5%) are also among the top 50 countries; they are not displayed because their HIV estimates are not published by UNAIDS

Figure 15. Countries with >250 cervical cancer cases attributable to HIV in 2018, by UNAIDS region⸸



⸸ India, China and Russia also have >250 cases, but their HIV estimates are suppressed.

Figure 16. Forest plots for analyses by risk measure and continent

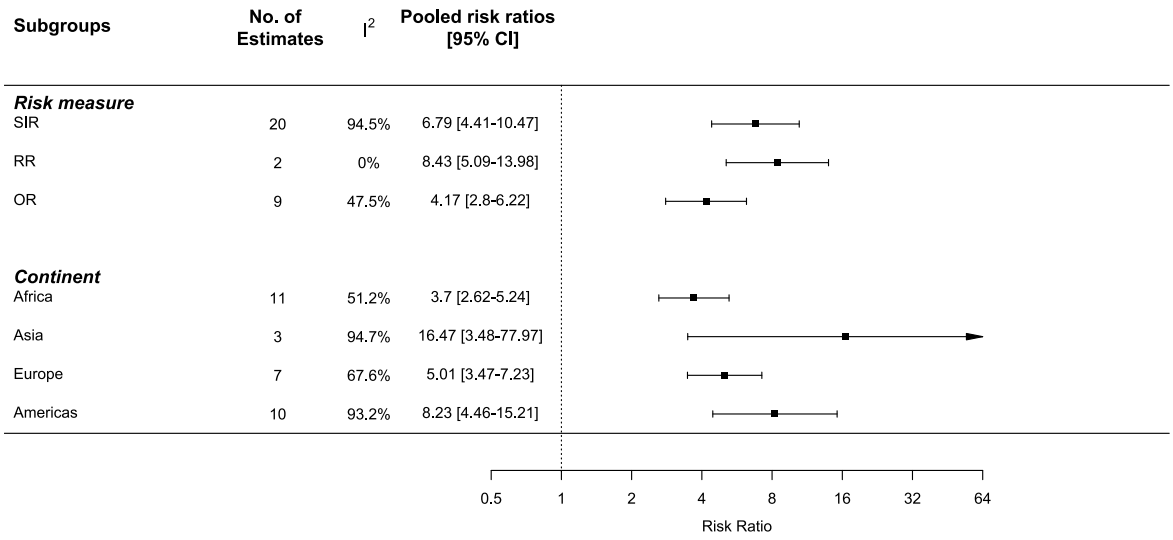


Table 7: Definition of WHO regions

WHO region	Country
Africa (AFRO)	Algeria
	Angola
	Benin
	Botswana
	Burkina Faso
	Burundi
	Cabo Verde
	Cameroon
	Central African Republic (the)
	Chad
	Comoros (the)
	Congo
	Côte d'Ivoire
	Democratic Republic of the Congo (the)
	Equatorial Guinea
	Eritrea
	Eswatini
	Ethiopia
	Gabon
	Gambia
	Ghana
	Guinea
	Guinea-Bissau
	Kenya
	Lesotho
	Liberia
	Madagascar
	Malawi
	Mali
	Mauritania
	Mauritius
	Mozambique
	Namibia
	Niger
	Nigeria
	Rwanda
	Sao Tome and Principe
	Senegal
	Seychelles
	Sierra Leone
	South Africa
	South Sudan
	Togo
	Uganda

	United Republic of Tanzania
	Zambia
	Zimbabwe
America (PAHO)	Antigua and Barbuda
	Argentina
	Bahamas (the)
	Barbados
	Belize
	Bolivia
	Brazil
	Canada
	Chile
	Colombia
	Costa Rica
	Cuba
	Dominica
	Dominican Republic (the)
	Ecuador
	El Salvador
	Grenada
	Guatemala
	Guyana
	Haiti
	Honduras
	Jamaica
	Mexico
	Nicaragua
	Panama
	Paraguay
	Peru
	Saint Kitts and Nevis
	Saint Lucia
	Saint Vincent and the Grenadines
	Suriname
	Trinidad and Tobago
	United States of America
	Uruguay
	Venezuela
Eastern Mediterranean (EMRO)	Afghanistan
	Bahrain
	Djibouti
	Egypt
	Iran
	Iraq
	Jordan
	Kuwait

	Lebanon
	Libya
	Morocco
	Occupied Palestinian Territory
	Oman
	Pakistan
	Qatar
	Saudi Arabia
	Somalia
	Sudan
	Syrian Arab Republic
	Tunisia
	United Arab Emirates
	Yemen
Europe (EURO)	Albania
	Andorra
	Armenia
	Austria
	Azerbaijan
	Belarus
	Belgium
	Bosnia and Herzegovina
	Bulgaria
	Croatia
	Cyprus
	Czech Republic
	Denmark
	Estonia
	Finland
	France
	Georgia
	Germany
	Greece
	Hungary
	Iceland
	Ireland
	Israel
	Italy
	Kazakhstan
	Kosovo
	Kyrgyzstan
	Latvia
	Liechtenstein
	Lithuania
	Luxembourg
	Malta

	Monaco
	Montenegro
	Netherlands
	North Macedonia
	Norway
	Poland
	Portugal
	Republic of Moldova
	Romania
	Russian Federation
	San Marino
	Serbia
	Slovakia
	Slovenia
	Spain
	Sweden
	Switzerland
	Tajikistan
	Turkey
	Turkmenistan
	Ukraine
	United Kingdom
	Uzbekistan
South-East Asia (SEARO)	Bangladesh
	Bhutan
	Democratic People's Republic of Korea (the)
	India
	Indonesia
	Maldives
	Myanmar
	Nepal
	Sri Lanka
	Thailand
	Timor-Leste
Western Pacific (WPRO)	Australia
	Brunei Darussalam
	Cambodia
	China
	Cook Islands
	Fiji
	Japan
	Kiribati
	Lao People's Democratic Republic
	Malaysia
	Marshall Islands
	Micronesia (Federated States of)

	Mongolia
	Nauru
	New Zealand
	Palau
	Papua New Guinea
	Philippines
	Republic of Korea
	Samoa
	Singapore
	Solomon Islands
	Tonga
	Tuvalu
	Vanuatu
	Viet Nam

Table 8. Definition of UN Africa subregion

WHO subregion	Country
Eastern Africa	Burundi
	Comoros
	Djibouti
	Eritrea
	Ethiopia
	Kenya
	Madagascar
	Malawi
	Mauritius
	Mayotte
	Mozambique
	Réunion
	Rwanda
	Seychelles
	Somalia
	South Sudan
	Uganda
	United Republic of Tanzania
	Zambia
	Zimbabwe
Central Africa	Angola
	Cameroon
	Central African Republic
	Chad
	Congo
	Democratic Republic of the Congo
	Equatorial Guinea
	Gabon
	Sao Tome and Principe
Northern Africa	Algeria
	Egypt
	Libya
	Morocco
	Sudan
	Tunisia
	Western Sahara
Southern Africa	Botswana
	Eswatini
	Lesotho
	Namibia
	South Africa
Western Africa	Benin
	Burkina Faso
	Cabo Verde

	Côte d’Ivoire
	Gambia
	Ghana
	Guinea
	Guinea-Bissau
	Liberia
	Mali
	Mauritania
	Niger
	Nigeria
	Senegal
	Sierra Leone
	Togo

Table 9: Definition of UNAIDS regions

UNAIDS region	Country
Asia and the Pacific (AP)	Afghanistan
	Australia
	Bangladesh
	Bhutan
	Brunei Darussalam
	Cambodia
	China
	Cook Islands
	Democratic People's Republic of Korea (the)
	Fiji
	India
	Indonesia
	Japan
	Kiribati
	Lao People's Democratic Republic
	Malaysia
	Maldives
	Marshall Islands
	Micronesia (Federated States of)
	Mongolia
	Myanmar
	Nauru
	Nepal
	New Zealand
	Niue
	Pakistan
	Palau
	Papua New Guinea
	Philippines
	Republic of Korea
	Samoa
	Singapore
	Solomon Islands
	Sri Lanka
	Thailand
	Timor-Leste
	Tonga
	Tuvalu
	Vanuatu
	Viet Nam
Caribbean (CAR)	Antigua and Barbuda
	Bahamas (the)
	Barbados

	Belize
	Cuba
	Dominica
	Dominican Republic (the)
	Grenada
	Guyana
	Haiti
	Jamaica
	Saint Kitts and Nevis
	Saint Lucia
	Saint Vincent and the Grenadines
	Suriname
	Trinidad and Tobago
East and Southern Africa (ESA)	Angola
	Botswana
	Comoros (the)
	Eritrea
	Eswatini
	Ethiopia
	Kenya
	Lesotho
	Madagascar
	Malawi
	Mauritius
	Mozambique
	Namibia
	Rwanda
	Seychelles
	South Africa
	South Sudan
	Uganda
	United Republic of Tanzania
	Zambia
	Zimbabwe
Eastern Europe and Central Asia (EECA)	Albania
	Armenia
	Azerbaijan
	Belarus
	Bosnia and Herzegovina
	Georgia
	Kazakhstan
	Kyrgyzstan
	Montenegro
	North Macedonia
	Republic of Moldova
	Russian Federation

	Tajikistan
	Turkmenistan
	Ukraine
	Uzbekistan
Latin America (LA)	Argentina
	Bolivia
	Brazil
	Chile
	Colombia
	Costa Rica
	Ecuador
	El Salvador
	Guatemala
	Honduras
	Mexico
	Nicaragua
	Panama
	Paraguay
	Peru
	Uruguay
	Venezuela
Middle East and North Africa (MENA)	Algeria
	Bahrain
	Djibouti
	Egypt
	Iran
	Iraq
	Jordan
	Kuwait
	Lebanon
	Libya
	Morocco
	Occupied Palestinian Territory
	Oman
	Qatar
	Saudi Arabia
	Somalia
	Sudan
	Syrian Arab Republic
	Tunisia
	United Arab Emirates
	Yemen
West and Central Africa (WCA)	Benin
	Burkina Faso
	Burundi
	Cabo Verde

	Cameroon
	Central African Republic (the)
	Chad
	Congo
	Côte d'Ivoire
	Democratic Republic of the Congo (the)
	Equatorial Guinea
	Gabon
	Gambia
	Ghana
	Guinea
	Guinea-Bissau
	Liberia
	Mali
	Mauritania
	Niger
	Nigeria
	Sao Tome and Principe
	Senegal
	Sierra Leone
	Togo
Western and Central Europe and North America (WCENA)	Andorra
	Austria
	Belgium
	Bulgaria
	Canada
	Croatia
	Cyprus
	Czech Republic
	Denmark
	Estonia
	Finland
	France
	Germany
	Greece
	Hungary
	Iceland
	Ireland
	Israel
	Italy
	Kosovo
	Latvia
	Liechtenstein
	Lithuania
	Luxembourg
	Malta

	Monaco
	Netherlands
	Norway
	Poland
	Portugal
	Romania
	San Marino
	Serbia
	Slovakia
	Slovenia
	Spain
	Sweden
	Switzerland
	Turkey
	United Kingdom
	United States of America

Table 10: Definition of income level by the World Bank

Income group	**Country**		
High income	Andorra	Germany	Oman
	Antigua and Barbuda	Gibraltar	Palau
	Argentina	Greece	Panama
	Aruba	Greenland	Poland
	Australia	Guam	Portugal
	Austria	Hong Kong SAR	Puerto Rico
	Bahamas	Hungary	Qatar
	Bahrain	Iceland	San Marino
	Barbados	Ireland	Saudi Arabia
	Belgium	Isle of Man	Seychelles
	Bermuda	Israel	Singapore
	British Virgin Islands	Italy	Sint Maarten (Dutch part)
	Brunei Darussalam	Japan	Slovak Republic
	Canada	Korea	Slovenia
	Cayman Islands	Kuwait	Spain
	Channel Islands	Latvia	St. Kitts and Nevis
	Chile	Liechtenstein	St. Martin (French part)
	Croatia	Lithuania	Sweden
	Curaçao	Luxembourg	Switzerland
	Cyprus	Macao SAR	Taiwan
	Czech Republic	Malta	Trinidad and Tobago
	Denmark	Monaco	Turks and Caicos Islands
	Estonia	Netherlands	United Arab Emirates
	Faroe Islands	New Caledonia	United Kingdom
	Finland	New Zealand	United States
	France	Northern Mariana Islands	Uruguay
	French Polynesia	Norway	Virgin Islands (U.S.)

Upper middle income	Albania	Gabon	Nauru
	Algeria	Grenada	Paraguay
	American Samoa	Guatemala	Peru
	Armenia	Guyana	Romania
	Azerbaijan	Iran	Russian Federation
	Belarus	Iraq	Samoa
	Belize	Jamaica	Serbia
	Bosnia and Herzegovina	Jordan	South Africa
	Botswana	Kazakhstan	St. Lucia
	Brazil	Lebanon	St. Vincent and the Grenadines
	Bulgaria	Libya	Suriname
	China	Macedonia	Thailand
	Colombia	Malaysia	Tonga
	Costa Rica	Maldives	Turkey
	Cuba	Marshall Islands	Turkmenistan
	Dominica	Mauritius	Tuvalu
	Dominican Republic	Mexico	Venezuela
	Ecuador	Montenegro	
	Equatorial Guinea	Namibia	
Lower middle income	Angola	Indonesia	Papua New Guinea
	Bangladesh	Kenya	Philippines
	Bhutan	Kiribati	São Tomé and Principe
	Bolivia	Kosovo	Solomon Islands
	Cabo Verde	Kyrgyz Republic	Sri Lanka
	Cambodia	Lao PDR	Sudan
	Cameroon	Lesotho	Swaziland
	Congo	Mauritania	Timor-Leste
	Côte d'Ivoire	Micronesia	Tunisia
	Djibouti	Moldova	Ukraine
	Egypt	Mongolia	Uzbekistan

	El Salvador	Morocco	Vanuatu
	Georgia	Myanmar	Vietnam
	Ghana	Nicaragua	West Bank and Gaza
	Honduras	Nigeria	Zambia
	India	Pakistan	
Low income	Benin	Guinea-Bissau	Senegal
	Burkina Faso	Haiti	Sierra Leone
	Burundi	Korea	Somalia
	Central African Republic	Liberia	South Sudan
	Chad	Madagascar	Syrian Arab Republic
	Comoros	Malawi	Tajikistan
	Congo	Mali	Tanzania
	Eritrea	Mozambique	Togo
	Ethiopia	Nepal	Uganda
	Gambia	Niger	Yemen
	Guinea	Rwanda	Zimbabwe

Table 11. Countries and territories with no HIV estimates, for which no estimates of HIV-associated cervical cancer burden were calculated in this study

Country	Number of new cervical cancer cases 2018
France, Guadeloupe	39 [26–58]
France, La Réunion	70 [53–93]
France, Martinique	32 [22–48]
France, New Caledonia	30 [19–48]
French Guyana	29 [16–52]
French Polynesia	17 [9–31]
Gaza Strip and West Bank	38 [18–80]
Guam	18 [14–23]
Iraq	244 [205–291]
Puerto Rico	262 [229–300]
Saint Lucia	15 [7–31]
Samoa	10 [5–20]
Sao Tome and Principe	16 [6–42]
Solomon Islands	55 [44–68]
Vanuatu	21 [12–36]

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