

APPENDIX 1: MOOSE criteria checklist.

Criteria		Comment
Reporting of background should include		
√	Problem definition	Males are not accessing HIV services provided by ART programs in Africa as often as their female counterparts and appear to have worse outcomes.
√	Hypothesis statement	Males are at an increased risk of death compared to females enrolled in ART programs in Africa.
√	Description of study outcomes	Gender (male, female), on the risk of death, as measured by a hazard ratio (HR).
√	Type of exposure or intervention used	Enrollment in an ART program in Africa.
√	Type of study designs used	Observational cohort studies.
√	Study population	HIV-positive individuals enrolled in an ART program in Africa.
Reporting of search strategy should include		
√	Qualifications of searchers	Eric Druyts, MSc; Edward Mills PhD, MSc, LL.M.
√	Search strategy, including time period included in the synthesis and keywords	Week 1 [January 3-9], 2000 to week 1 [January 2-8], 2012. Refer to Appendix 2 for a full list of keywords.
√	Databases and registries searched	MedLine via PubMed, EMBASE, and Cochrane CENTRAL
√	Search software used, name and version, including special features	EndNote was used to merge retrieved citations and eliminate duplications.
√	Use of hand searching	Bibliographies of retrieved papers were hand-searched for additional references.
√	List of citations located and those excluded, including justifications	Details of the literature search process are outlined in the flow chart. The citation list for those excluded is available upon request.
√	Method of addressing articles published in languages other than English	We placed no restrictions on language. Translation services were available to us through the University of Ottawa if required.
√	Method of handling abstracts and unpublished studies	No searching of the grey literature performed.
√	Description of any contact with authors	None.
Reporting of methods should include		
√	Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	Detailed inclusion and exclusion criteria have been described in the methods section.
√	Rationale for the selection and coding of data	Data extracted from each study were relevant to the population characteristics, study design, exposure, and outcome.
√	Assessment of confounding	The adjustment for confounding in each included study is reported in the source publications.
√	Assessment of study quality, including blinding of quality assessors; stratification or regression on possible predictors of study results	The Newcastle-Ottawa Quality Assessment Scale was used.
√	Assessment of heterogeneity	Heterogeneity of the studies was examined with the I^2 statistic.

√	Description of statistical methods in sufficient detail to be replicated	The DerSimonian-Laird random effects method was used to pool the proportion of males and the HR of mortality (male versus female) in R version 2.14.0.
√	Provision of appropriate tables and graphics	Figures 1, 2 and 3 and Tables 1 and 2.
Reporting of results should include		
√	Graph summarizing individual study estimates and overall estimate	Figures 2 and 3.
√	Table giving descriptive information for each study included	Table 1.
√	Results of sensitivity testing	Table 2.
√	Indication of statistical uncertainty of findings	95% confidence intervals were provided with all summary estimates, I^2 values were included, and multiple sensitivity analyses and meta-regression were performed.
Reporting of discussion should include		
√	Quantitative assessment of bias	Sensitivity analyses were provided to determine the strength of the association due to potential biases in the included observational studies.
√	Justification for exclusion	All studies were excluded based on a pre-defined inclusion criteria.
√	Assessment of quality of included studies	There is considerable discussion of this issue in the limitations, study implications and conclusions sections.
Reporting of conclusions should include		
√	Consideration of alternative explanations for observed results	There is considerable discussion of this issue in the limitations section.
√	Generalization of the conclusions	There is considerable discussion of this issue in the study implications and conclusions sections.
√	Guidelines for future research	There is considerable discussion of this issue in the study implications and conclusions sections.
√	Disclosure of funding source	No separate funding was necessary for the undertaking of this systematic review and meta-analysis.

APPENDIX 2: Full electronic search strategy for PubMed.

((("hiv"[MeSH Terms] OR "hiv"[All Fields] OR ("human"[All Fields] AND "immunodeficiency"[All Fields] AND "virus"[All Fields]) OR "human immunodeficiency virus"[All Fields]) OR ("hiv"[MeSH Terms] OR "hiv"[All Fields]) OR ("acquired immunodeficiency syndrome"[MeSH Terms] OR ("acquired"[All Fields] AND "immunodeficiency"[All Fields] AND "syndrome"[All Fields]) OR "acquired immunodeficiency syndrome"[All Fields]) OR ("acquired immunodeficiency syndrome"[MeSH Terms] OR ("acquired"[All Fields] AND "immunodeficiency"[All Fields] AND "syndrome"[All Fields]) OR "acquired immunodeficiency syndrome"[All Fields]) OR "aids"[All Fields])) AND ((("mortality"[Subheading] OR "mortality"[All Fields] OR "survival"[All Fields] OR "survival"[MeSH Terms]) OR ("survival rate"[MeSH Terms] OR ("survival"[All Fields] AND "rate"[All Fields]) OR "survival rate"[All Fields]) OR ("mortality"[Subheading] OR "mortality"[All Fields] OR "mortality"[MeSH Terms]) OR ("mortality"[MeSH Terms] OR "mortality"[All Fields] OR ("mortality"[All Fields] AND "rate"[All Fields]) OR "mortality rate"[All Fields]) OR ("death"[MeSH Terms] OR "death"[All Fields]) OR ("mortality"[Subheading] OR "mortality"[All Fields] OR "death"[All Fields] AND "rate"[All Fields]) OR "death rate"[All Fields] OR "mortality"[MeSH Terms] OR "death"[All Fields] AND "rate"[All Fields]) OR "death rate"[All Fields])) AND (antiretroviral[All Fields] OR anti-retroviral[All Fields] OR (antiretroviral[All Fields] AND ("therapy"[Subheading] OR "therapy"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields])) OR ("antiretroviral therapy, highly active"[MeSH Terms] OR ("antiretroviral"[All Fields] AND "therapy"[All Fields] AND "highly"[All Fields] AND "active"[All Fields]) OR "highly active antiretroviral therapy"[All Fields] OR ("highly"[All Fields] AND "active"[All Fields] AND "antiretroviral"[All Fields] AND "therapy"[All Fields])) OR ("antiretroviral therapy, highly active"[MeSH Terms] OR ("antiretroviral"[All Fields] AND "therapy"[All Fields] AND "highly"[All Fields] AND "active"[All Fields]) OR "highly active antiretroviral therapy"[All Fields] OR "haart"[All Fields]) OR ("anti-hiv agents"[MeSH Terms] OR ("anti-hiv"[All Fields] AND "agents"[All Fields]) OR "anti-hiv agents"[All Fields] OR ("anti"[All Fields] AND "hiv"[All Fields] AND "agents"[All Fields]) OR "anti hiv agents"[All Fields] OR "anti-hiv agents"[Pharmacological Action])) AND ("2004/01/01"[PDAT] : "3000"[PDAT] NOT clinical trial[Publication Type])) AND (("algeria"[MeSH Terms] OR "algeria"[All Fields]) OR ("angola"[MeSH Terms] OR "angola"[All Fields]) OR ("benin"[MeSH Terms] OR "benin"[All Fields]) OR ("botswana"[MeSH Terms] OR "botswana"[All Fields]) OR ("burkina faso"[MeSH Terms] OR "burkina faso"[All Fields]) OR ("burkina faso"[MeSH Terms] OR "burkina faso"[All Fields]) OR ("burundi"[MeSH Terms] OR "burundi"[All Fields]) OR ("cameroon"[MeSH Terms] OR "cameroon"[All Fields]) OR ("cape verde"[MeSH Terms] OR "cape verde"[All Fields]) OR ("central african republic"[MeSH Terms] OR "central african republic"[All Fields]) OR ("central african republic"[MeSH Terms] OR "central african republic"[All Fields]) OR ("chad"[MeSH Terms] OR "chad"[All Fields]) OR ("comoros"[MeSH Terms] OR "comoros"[All Fields]) OR ("congo"[MeSH Terms] OR "congo"[All Fields]) OR ("cote d'ivoire"[MeSH Terms] OR "cote d'ivoire"[All Fields] AND "d'ivoire"[All Fields]) OR "cote d'ivoire"[All Fields]) OR Cote[All Fields] OR ("democratic republic of the congo"[MeSH Terms] OR "democratic republic of the congo"[All Fields]) OR ("equatorial guinea"[MeSH Terms] OR "equatorial guinea"[All Fields]) OR "guinea"[All Fields] OR "equatorial guinea"[All Fields] OR ("eritrea"[MeSH Terms] OR "eritrea"[All Fields]) OR ("ethiopia"[MeSH Terms] OR "ethiopia"[All Fields]) OR ("gabon"[MeSH Terms] OR "gabon"[All Fields]) OR ("gambia"[MeSH Terms] OR "gambia"[All Fields]) OR ("ghana"[MeSH Terms] OR "ghana"[All Fields]) OR ("guinea"[MeSH Terms] OR "guinea"[All Fields]) OR ("guinea-bissau"[MeSH Terms] OR "guinea-bissau"[All Fields] OR ("guinea"[All Fields] AND "bissau"[All Fields]) OR "guinea bissau"[All Fields]) OR ("kenya"[MeSH Terms] OR "kenya"[All Fields]) OR ("lesotho"[MeSH Terms] OR "lesotho"[All Fields]) OR ("liberia"[MeSH Terms] OR "liberia"[All Fields]) OR ("madagascar"[MeSH Terms] OR "madagascar"[All Fields]) OR ("malawi"[MeSH Terms] OR "malawi"[All Fields]) OR ("mali"[MeSH Terms] OR "mali"[All Fields]) OR ("mauritania"[MeSH Terms] OR "mauritania"[All Fields]) OR ("mauritiu"[MeSH Terms] OR "mauritiu"[All Fields]) OR ("mozambique"[MeSH Terms] OR "mozambique"[All Fields]) OR ("namibia"[MeSH Terms] OR "namibia"[All Fields]) OR ("niger"[MeSH Terms] OR "niger"[All Fields]) OR ("nigeria"[MeSH Terms] OR "nigeria"[All Fields]) OR ("rwanda"[MeSH Terms] OR "rwanda"[All Fields]) OR ("atlantic islands"[MeSH Terms] OR ("atlantic"[All Fields] AND "islands"[All Fields]) OR "atlantic islands"[All Fields] OR ("sao"[All Fields] AND "tome"[All Fields] AND "principe"[All Fields]) OR "sao tome and principe"[All Fields]) OR (Sao[All Fields] AND Tome[All Fields]) OR Principe[All Fields] OR ("senegal"[MeSH Terms] OR "senegal"[All Fields]) OR ("seychelles"[MeSH Terms] OR "seychelles"[All Fields]) OR ("sierra leone"[MeSH Terms] OR ("sierra"[All Fields] AND "leone"[All Fields]) OR "sierra leone"[All Fields]) OR ("somalia"[MeSH Terms] OR "somalia"[All Fields]) OR ("south africa"[MeSH Terms] OR ("south"[All Fields] AND "africa"[All Fields]) OR "south africa"[All Fields]) OR ("swaziland"[MeSH Terms] OR "swaziland"[All Fields]) OR ("togo"[MeSH Terms] OR "togo"[All Fields]) OR ("uganda"[MeSH Terms] OR "uganda"[All Fields]) OR ("tanzania"[MeSH Terms] OR "tanzania"[All Fields] OR ("united"[All Fields] AND "republic"[All Fields] AND "tanzania"[All Fields]) OR "united republic of tanzania"[All Fields]) OR ("tanzania"[MeSH Terms] OR "tanzania"[All Fields]) OR ("zambia"[MeSH Terms] OR "zambia"[All Fields]) OR ("zimbabwe"[MeSH Terms] OR "zimbabwe"[All Fields]) OR ("africa south of the sahara"[MeSH Terms] OR ("africa"[All Fields] AND "south"[All Fields] AND

"sahara"[All Fields] OR "africa south of the sahara"[All Fields] OR ("sub"[All Fields] AND "saharan"[All Fields] AND "africa"[All Fields]) OR "sub saharan africa"[All Fields]) OR ("africa south of the sahara"[MeSH Terms] OR ("africa"[All Fields] AND "south"[All Fields] AND "sahara"[All Fields]) OR "africa south of the sahara"[All Fields] OR ("subsaharan"[All Fields] AND "africa"[All Fields]) OR "subsaharan africa"[All Fields]) OR ("africa south of the sahara"[MeSH Terms] OR ("africa"[All Fields] AND "south"[All Fields] AND "sahara"[All Fields]) OR "africa south of the sahara"[All Fields] OR ("africa"[All Fields] AND "sub"[All Fields] AND "saharan"[All Fields])) OR ("africa"[MeSH Terms] OR "africa"[All Fields]) OR (East[All Fields] AND ("africa"[MeSH Terms] OR "africa"[All Fields])) OR (("west"[All Fields] AND "africa"[All Fields]) OR "west africa"[All Fields]) OR ("africa, southern"[MeSH Terms] OR ("africa"[All Fields] AND "southern"[All Fields]) OR "southern africa"[All Fields] OR ("southern"[All Fields] AND "africa"[All Fields]))))

APPENDIX 3: Characteristic of included cohort studies.

Study	Country	No.	Males	Age	Tuberculosis co-infection	WHO Stage	CD4 cell count	Pregnancy	Lost to follow-up	Duration of follow-up (months)
Kouanda et al, 2012 ⁴⁴	Burkina Faso	5,608	30.0%	35 (30-41)**	NA	Stage I/II: 18.4%; Stage III: 53.6%; Stage IV: 28.0%	<50: 20.2%; 50-99: 19.5%; 100-199: 42.9%; 200-349: 15.2%; 350+: 2.1%	NA	NA	23.2 (12.4-36.9)**
Weigel et al, 2012 ⁴³	Malawi	117,945	39.6%	0-1: 1.0%; 2-5: 3.2%; 6-14: 4.2%; 15-24: 7.5%; 25-34: 34.5%; 35-44: 30.8%; 45+: 18.8%	NA	Stage I/II: 14.3%; Stage III/IV: 85.7%	NA	NA	10.0%	NA
Boyles et al, 2011 ²⁴	South Africa	1,803	22.7%	32 (27-39)**	NA	NA	123 (55-184)**	10.2%	6.5%	13.3 (5.4-25.0)**
Hawkins et al, 2011 ³⁰	Tanzania	12,842	34.1%	Male: 41 (9.7)* Female: 36 (9.0)*	Male: 16.5% Female: 11.3%	Male: Stage I/II: 17%; Stage III: 56%; Stage IV: 27% Female: Stage I/II: 23%; Stage III: 54%; Stage IV: 23%	Male: 123 (112)* Female: 136 (134)*	Pregnant women were excluded.	Male: 23.8% Female: 22.2%	Male: 8.4 (8.6)* Female: 9.0 (8.9)*
Maskew et al, 2011 ³³	South Africa	9,139	38.2%	Male: 18-29: 11.4%; 30-39: 49.1%; 40-49: 28.0%; 50-59: 9.6%; 60+: 1.8% Female: 18-29: 23.7%; 30-39: 45.8%; 40-49: 22.8%; 50-59: 6.8%; 60+: 0.8%	NA	Stage I/II: 52.6%; Stage III: 39.0%; Stage IV: 8.4%	74 (27-144)**	Pregnant women were excluded.	14.8%	24.0 (13.5-24.0)**
Mills et al, 2011 ³⁴	Uganda	22,315	30.6%	Male: 14-19: 1.5%; 20-29: 9.1%; 30-39: 41.2%; 40-49: 33.1%; 50+: 15.2% Female: 14-19: 1.5%; 20-29: 18.5%; 30-39: 45.0%; 40-49: 26.0%; 50+: 9.0%	Male: 6.8% Female: 4.2%	Male: Stage I: 2.7%; Stage II: 51.2%; Stage III: 36.5%; Stage IV: 9.6% Female: Stage I: 3.4%; Stage II: 56.0%; Stage III: 32.9%; Stage IV: 7.8%	Male: <50: 22.8%; 50-99 17.8%; 100-149: 18.2%; 150-249: 28.3%; 250+: 12.9% Female: <50: 16.9%; 50-99: 15.1%; 100-149: 18.5%; 150-249: 32.2%; 250+: 17.3%	NA	Males: 7.5% Females: 5.9%	Male: 32 (20-47)** Female: 30 (18-39)**
Peterson et al, 2011 ³⁹	Gambia	359	33.7%	35 (29-42); 42 (32-48)**‡	NA	Stage I: 29.2%; Stage II: 23.4; Stage III: 35.4; Stage IV: 12.0	110.0 (50.0-200.0); 140.0 (50.0-310.0)**‡	NA	3.3%	12.1 (4.9-30.4); 20.3 (10.0-33.0)**‡
Alemu et al, 2010 ²²	Ethiopia	272	43.0%	33 (18-68)***	23.2%	Stage I: 9.1%; Stage II: 20.0%; Stage III: 54.0%; Stage IV:	≤50: 20.2%; 51-200: 64.8%; >200: 15.0%	NA	18%	24**

Boulle et al, 2010 ²³	South Africa	7,323	32.3%	Male: 36 (31-42)** Female: 31 (27-37)**	37.7%	16.9% Stage I/II: 15.7%; Stage III: 48.8%; Stage IV: 35.5%	101 (45-164)**	2.5%	9.8%	NA
Chi et al, 2010 ²⁶	Zambia	10,485	44.0%	35 (30-41); 34 (29-39); 33 (28-39)**†	11.7%	Stage I/II: 42.0%; Stage III: 52.1%; Stage IV: 5.9%	149 (84-210); 171 (105-228); 176 (103-259)**†	NA	NA	6.8 (2.9-11.4); 10.1 (4.3-15.7); 9.0 (4.0-14.9)**†
Ford et al, 2010 ²⁹	Lesotho	1,228	32.6%	38 (30-49)**	17.0%	NA	212 (120-285)**	6.8%	NA	16.6 (13.0-20.0)**
Mulissa et al, 2010 ³⁶	Ethiopia	1,428	46.4%	33 (26-38)*	14.9%	Stage I: 18.2%; Stage II: 19.4%; Stage III: 49.2%; Stage IV: 13.3%	156 (81-237)**	NA	13.4%	17.7 (6.2-31.5)**
Mutevedzi et al, 2010 ³⁷	South Africa	5,719	32.1%	Male: 37 (32-45)** Female: 34 (28-41)**	18.1%	Stage III/IV: 82.8%	Male: 91 (41-156)** Female: 128 (66-179)**	5.2%	3.7%	NA
Palombia et al, 2010 ³⁸	Mozambique	753	41.4%	34 (28-41)**	NA	NA	172 (87-261)**	NA	NA	36 (12-48)**
Castelnuovo et al, 2009 ²⁵	Uganda	559	30.9%	38 (33-44)**	NA	Stage III/IV: 89%	98 (21-163)**	NA	NA	NA
Cornell et al, 2009 ²⁷	South Africa	2,196	32.7%	Male: 36 (31-42)** Female: 31 (27-36)**	NA	Male: Stage I/II: 16%; Stage III: 55%; Stage IV: 29% Female: Stage I/II: 26%; Stage III: 54%; Stage IV: 20%	Male: 89 (39-149)** Female: 107 (56-160)**	NA	Male: 7% Female: 6%	12 (6-12)**
DeSilva et al, 2009 ²⁸	Nigeria	1,552	29.1%	Male: 38 (21-75)*** Female: 32 (17-76)***	Male: 19.7% Female: 14.7%	NA	Male: 109 (1-1314)*** Female: 113 (1-631)***	NA	Male: 9.29% Female: 8.64%	NA
MacPherson et al, 2009 ³²	South Africa	1,353	33.0%	37 (31-45)**	NA	Stage III: 53%; Stage IV: 10.7%	93 (37-148)**	NA	2.6%	NA
Mujugira et al, 2009 ³⁵	Botswana	349	41.3%	Men: 36 (17-64)*** Women: 34 (19-68)***	NA	Male: Stage I: 1%; Stage II: 7%; Stage III: 28%; Stage IV: 64% Female: Stage I: 4%; Stage II: 7%; Stage III: 30%; Stage IV: 59%	Male: 22 (0-48)*** Female: 22 (1-49)**	NA	12.6%	14.4 (0-22.7)***

Sieleunou et al, 2009 ⁴⁰	Cameroon	1,187	55.6%	35 (29-41)**	NA	Stage I/II: 9.6%; Stage III/IV: 90.4%	105 (40-173)**	NA	5.0%	NA
van Griensven et al, 2009 ⁴²	Rwanda	1,062	24.8%	≤35 years: 44% >35 years: 56%	NA	Stage I/II: 28.9%; Stage III/IV: 71.1%	149**	NA	NA	13 (6-15)
Johannesse et al, 2008 ³¹	Tanzania	320	30.3%	35 (30-43)**	NA	Stage I/II: 3.8%; Stage III: 30.6%; Stage IV: 65.6%	NA	Pregnant women were excluded.	36.8%	10.9 (2.9-19.6)
Toure et al, 2008 ⁴¹	Cote d'Ivoire	10,211	29.6%	36 (30-42)**	5.5%	Stage I/II: 19%; Stage III: 69%; Stage IV: 12%	123 (47-207)**	NA	14%	7.7 (2.6-15.5)**

Note: Where possible, data are extracted for males and females separately.

NA, not available.

*Mean (standard deviation)

**Median (interquartile range)

***Median (mix, max)

†Values represent patients treated with Tenofovir+Emtricitabine, Zidovudine+Lamivudine, and Stavudine+Lamivudine, respectively.

‡Values represent patients with HIV-1 and HIV-2, respectively.

APPENDIX 4: Newcastle-Ottawa Quality Assessment of the included studies.

Study	Selection				Comparability	Outcome		
	Representative ness of cohort	Selection of non-exposed cohort	Ascertainment of exposure	Outcome of interest	Comparability of cohorts	Assessment of outcome	Adequate duration of follow-up	Adequate follow-up of cohort
Kouanda et al, 2012 ⁴⁴	*	*	*	*	**	*	*	*
Boyles et al, 2011 ²⁴	*	*	*	*	**	*	*	*
Hawkins et al, 2011 ³⁰	*	*	*	*	**	*	*	*
Maskew et al, 2011 ³³	*	*	*	*	**	*	*	*
Mills et al, 2011 ³⁴	*	*	*	*	**	*	*	*
Peterson et al, 2011 ³⁹	*	*	*	*	**	*	*	*
Weigel et al, 2011 ⁴³	*	*	*	*	**	*	*	*
Alemu et al, 2010 ²²	*	*	*	*		*	*	*
Boulle et al, 2010 ²³	*	*	*	*	**	*	*	*
Chi et al, 2010 ²⁶	*	*	*	*	**	*	*	*
Ford et al, 2010 ²⁹	*	*	*	*	**	*	*	*
Mulissa et al, 2010 ³⁶	*	*	*	*	**	*	*	*
Mutevedzi et al, 2010 ³⁷	*	*	*	*	**	*	*	*
Palombia et al, 2010 ³⁸	*	*	*	*	**	*	*	*
Castelnuovo et al, 2009 ²⁵	*	*	*	*		*	*	*
Cornell et al, 2009 ²⁷	*	*	*	*	**	*	*	*
DeSilva et al, 2009 ²⁸	*	*	*	*	**	*	*	*
MacPherson et al, 2009 ³²	*	*	*	*	**	*	*	*
Mujugira et al, 2009 ³⁵	*	*	*	*	**	*	*	*
Sieleunou et al, 2009 ⁴⁰	*	*	*	*	**	*	*	*
van Griensven et al, 2009 ⁴²	*	*	*	*	**	*	*	*
Johannessen et al, 2008 ³¹	*	*	*	*	**	*	*	*

Toure et al, 2008 ⁴¹	*	*	*	*	**	*	*	*
---------------------------------	---	---	---	---	----	---	---	---

Note: A study can be awarded a maximum of one star for each item within the selection and outcome categories. A maximum of two stars can be given for comparability. In our case, comparability refers to whether or not one or more variables in addition to gender were adjusted for in a multivariable survival model.