**Supplementary Material**

Title: **Impact of HIV infection on baseline characteristics and survival of women with breast cancer: a systematic review and meta-analysis**

**Supplementary Methods**

**Search strategy**

Searches covering the periods from inception of each database to 1 January 2020

1. **MEDLINE**

("breast cancer" OR "breast neoplasm" OR “breast tumor” OR “breast tumors” OR “breast tumour” OR “breast tumours” OR "Breast Neoplasms"[MeSH] OR “breast”) AND (“HIV” OR “Human Immunodeficiency Virus” OR “Immunodeficiency Virus, Human” OR “AIDS” OR “Acquired Immune Deficiency Syndrome Virus” OR “Acquired Immune Deficiency Syndrome”) NOT (animals [mh] NOT humans [mh])

**2. Scopus**

( TITLE-ABS-KEY ( "breast cancer" OR "breast neoplasm" OR "breast tumor" OR "breast tumors" OR "breast tumour" OR "breast tumours" OR "breast") AND TITLE-ABS-KEY ( "HIV" OR "Human Immunodeficiency Virus" OR "Immunodeficiency Virus, Human" OR "AIDS" OR "Acquired Immune Deficiency Syndrome Virus" OR "Acquired Immune Deficiency Syndrome" ) ) AND PUBYEAR < 2020

**3. ISI Web of Knowledge**

ALL=( "breast cancer" OR "breast neoplasm" OR "breast tumor" OR "breast tumors" OR "breast tumour" OR "breast tumours" OR “breast”) AND ALL=( "HIV" OR "Human Immunodeficiency Virus" OR "Immunodeficiency Virus, Human" OR "AIDS" OR "Acquired Immune Deficiency Syndrome Virus" OR "Acquired Immune Deficiency Syndrome" )

4. **LILACS**

Breast AND HIV

5. **SciELO**

Breast AND HIV

Manual search of abstracts from major conferences, taking place from 2016 to January 2020:

* American Society of Clinical Oncology Annual Meeting
* AORTIC's International Conference on Cancer in Africa
* Conference on Retroviruses and Opportunistic Infections
* ESMO Breast Cancer Congress
* European Society for Medical Oncology (ESMO) Congress
* San Antonio Breast Cancer Symposium

**Supplementary Table 1 – Quality assessment of studies included.**

| **First author, year** | **Study design** | **Pros-pective?** | **BC only?** | **Patient selection** | **Stage definition according to TNM classification** | **Definition of ER and HER2 status**  | **Survival analysis: median FU and loss to FU** | **Survival analysis: Adjustment for confounding** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Biggar et al (2005) [1] | Linkage study | No | No | Population-based study: linked data about persons from the statewide New York State Cancer Registry to persons registered in the New York City HIV/AIDS Registry to obtain information about the AIDS status of the cancer cases. **Low risk** | NA | NA | FU was limited to 24 months after cancer diagnoses. Death information was considered to be more than 95% complete by the New York State Cancer Registry. **Low-medium risk.** | Yes: for sex, race, age, year of cancer diagnosis. **Low-medium risk** |
| Sseggwanyi et al (2011) [2] | Case series (single-center) | Yes | Yes | One teaching hospital from Uganda. Only patients with known HIV status included. **Low risk** | Authors collected staging information from medical records, and classified patients according to the TNM staging system. **Low risk** | NA | NA | NA |
| Coghill et al (2013) [3] | Cancer registry | No | No | Data retrieved from a cancer registry in Uganda. HIV status was retrospectively collected and both patients with known and unknown status were included – patients with unknown HIV status were considered as “HIV negative” (and the country in which the study was conducted has a prevalence of HIV infection >5.0%). **Medium risk** | Authors collected staging information from medical records, and classified patients into 2 groups, whenever they had this data available: lower stage (I – II) and advanced stage (III – IV) according to the TNM staging system. **Low risk** | NA | Median FU was not provided; 40% of patients overall were lost follow-up. **High risk**  | Yes: for age, year of cancer diagnosis, stage. **Low risk** |
| Cubasch et al (2013) [4] | Case series (single-center) | No | Yes | Data retrieved from an electronic database of an academic hospital in South Africa. Known HIV status, with a 2-exam algorithm. **Low risk** | Authors reported data using the TNM staging system. **Low risk** | Authors collected ER and HER2 status information from medical records, and classified patients according to the following rules: ER <1% was considered negative and HER2 0, 1+, and 2+ were considered negative. **Medium risk**  | NA | NA |
| Cubasch et al (2018) [5] | Data retrieved from an electronic database of an academic hospital in South Africa. Among included patients, 17% had unknown HIV status, but survival analysis was reported separately for “HIV-positive”, “HIV-negative” and “HIV-unknown”.**Low risk** | Authors reported data using the TNM staging system. **Low risk** | Authors collected ER and HER2 status information from medical records, and classified patients according to the following rules: ER <1% was considered negative and HER2 0, 1+, and 2+ were considered negative. **Medium risk** | Median follow-up reported; 48% of patients were lost follow-up.**High risk** | Yes: for age, stage, grade and BC subtype. **Low risk** |
| Shiels et al (2015) [6] | Linkage study (HACM study) | No | No | Two national databases (US HIV and cancer registries) in the US, automatically matched by social security number. **Low risk**  | SEER classification as local, regional, distant and unknown. **Low risk** | NA | NA | NA |
| Coghill et al (2015) [7] | Two national databases (US HIV and cancer registries) in the US automatically matched by social security number. **Low risk** | SEER classification as local, regional, distant and unknown.**Low risk** | NA | NA | Yes: for age, sex, stage, year of cancer diagnosis, race/ethnicity. **Low risk** |
| Traore et al (2015) [8] | Case series (single-center) | No | Yes | Single-center study, selection based on medical records. Authors do not describe how HIV status was evaluated among “HIV-uninfected” patients. **Medium risk** | Authors collected staging information from medical records, and classified patients into 2 groups: lower stage (I – II) and advanced stage (III – IV) according to the TNM staging system. **Low risk** | NA | NA | NA |
| Phakathi et al (2016) [9] | Case series (single-center) | Yes | Yes | Prospective cohort of a state hospital in South Africa. Only patients with known HIV status were included in the analysis (representing 96% of patients included in the cohort).**Low risk** | Patients were classified according to the TNM staging system.**Low risk** | NA | NA | NA |
| Langenhoven et al (2016) [10] | Case series (single-center) | No | Yes | Single-center study, selection based on medical records; 23% of patients had an unknown HIV status.**Medium risk** | Authors collected staging information from medical records, and classified patients according to the TNM staging system. **Low risk** | Authors collected ER and HER2 status information from medical records; they fail to report how this was classified for the study.**Medium risk** | NA | NA |
| Ngidi et al (2017) [11] | Case series (multicentric) | No | Yes | Retrospective analysis of medical charts from 2 South African hospitals. Analysis restricted to patients treated with chemotherapy for breast cancer. Only patients with known HIV status included; do not state the amount of patients excluded due to unknown HIV status.**Low-medium risk** | Authors collected staging information from medical records, and classified patients according to the TNM staging. **Low risk** | Authors collected ER and HER2 status information from medical records; they fail to report how this was classified for the study.**Medium risk** | NA | NA |
| Presti et al (2017) [12] | Case series (multi-centric) | No | Yes | Retrospective chart review from 4 hospitals in the USA. HIV status was retrospectively collected and both patients with known and unknown status were included – patients with unknown HIV status were considered as “HIV negative”, but the proportion of “HIV unknown” is not provided (but the prevalence of HIV in the country where the study was conducted is <0.5%). **Low-medium risk** | Authors collected staging information from medical records, and classified patients according to TNM staging. **Low risk** | Authors collected ER and HER2 status information from medical records; they fail to report how this was classified for the study.**Medium risk** | NA | NA |
| McKenzie et al (2018) [13] | Cohort (multi-country – ABC-DO study) | Yes | Yes | Observational cohort study of women newly diagnosed with breast cancer in tertiary cancer centers from 5 African countries. HIV infection status was based on testing in South Africa, but it was self-reported in the other participating countries. **Medium risk** | Authors collected staging information from medical records, and classified patients into 2 groups: lower stage (I – II) and advanced stage (III – IV) according to TNM staging. **Low risk** | Authors collected ER and HER2 status information from medical records, and classified patients according to ASCO/CAP guidelines.[14–16] **Low risk** | NA | NA |
| Van Zyl et al (2018) [17] | Case series (single-center) | No | Yes | Single-center study, selection based on medical records. Only patients with known HIV status were included in this analysis (representing 49% of patients initially assessed). **Medium risk**  | Authors collected staging information from medical records, and classified patients according to TNM staging. **Low risk** | ER and HER2 status information were retrieved from a national laboratory database; they fail to report how this was classified for the study. **Medium risk**  | NA | NA |
| Sadigh et al (2019) [18] | Cohort (multi-centric; Thabatse Cancer Cohort) | Yes | Yes | 4 sites from Botswana. Only patients with known HIV status were included in this analysis (representing 96% of patients initially assessed). **Low risk**  | Authors reported data using the TNM definition. **Low risk**  | Authors report ER status, but no PR status. HER2 status was assessed only by immunohistochemistry.**Medium-high risk**  | Follow-up period is reported, and authors have described the number of patients who lost follow-up (1%). **Low risk**  | Yes: for age, stage, BC subtype, and income.**Low risk** |
| Brandao et al (2019) [19] | Cohort (multi-centric; Moza-BC Cohort) | Yes | Yes | 3 sites from Mozambique, but patients followed in 1 of the sites. Almost all patients had known HIV status (96% of patients in the cohort). **Low risk**  | Authors reported data using the TNM definition. **Low risk**  | According to ASCO/CAP guidelines.[14–16] **Low risk** | Median follow-up reported, and authors have described the number of patients who were lost follow-up (11%).**Low-medium risk**  | Yes: for age, stage, BC subtype, and any treatment received (yes vs. no). **Low risk** |
| Phakathi et al (2019) [20] | Consecutive series (2 centers) | No | Yes | 5 hospitals from South Africa. Only patients with known HIV status included in the analyses (representing 96.8% of patients initially assessed). **Low risk**  | Authors reported data using the TNM definition. **Low risk** | HER2 status was defined according to ASCO/CAP guidelines, whereas ER and PR status were defined according to Allred score (3-8 considered positive). **Low-medium risk**  | NA | NA |
| Bhatia et al (2019) [21] | Case series | No | Yes | Retrieved data from 2 national datasets. No information regarding the presence of distant metastases was available. Complete tumor and nodal staging was available for 13% of the specimens. **Medium-high risk**  | For the patients who had staging data available, it was reported using the TNM definition. **Low risk**  | ER and PR status reported according to ASCO/CAP guidelines. HER2 status assessed only with IHC, no ISH performed (+3 were considered HER2-positive)**Medium risk**  | NA | NA |
| Ayeni et al (2019) [22] | Cohort (SABCHO) | Yes | Yes | Prospective cohort, 5 hospitals from South Africa. Almost all patients had known HIV status (95%). **Low risk**  | Authors reported data using the TNM definition. **Low risk** | ER, PR and HER2 status retrieved from medical records; they fail to report how this was classified for the study.**Medium-high risk**  | NA | NA |
| Coghill et al (2019) [23] | Cancer registry (NCDB) | No | No | Data was retrieved from a National database. HIV testing was not performed routinely in all of these patients (but the prevalence of HIV in the country where the study was conducted is <0.5%). **Low-medium risk**  | Authors reported data using the TNM definition. **Low risk** | NA | NA | Yes: for age, sex, race, stage, year of cancer diagnosis, median household income (by zip code), treatment, type of individual health insurance and treating cancer facility. **Low risk** |

ABC-DO=African Breast Cancer - Disparities in Outcomes study. ASCO/CAP=American Society of Clinical Oncology / College of American Pathologists. BC=breast cancer. ER=estrogen receptor. HACM=HIV/AIDS Cancer Match study. NCDB=National Cancer Database. NA=not applicable (variable not evaluated in the study). SABCHO=South African Breast Cancer and HIV Outcomes Study. SEER= Surveillance, Epidemiology, and End Results Program.

**Supplementary Figure 1 – Funnel plot of publication bias among studies evaluating the likelihood of presenting with locally advanced/metastatic stage (III/IV) at diagnosis among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.543

**Supplementary Figure 2 – Funnel plot of publication bias among studies evaluating the likelihood of presenting with ER-positive/HER2-negative subtype among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.383

**Supplementary Figure 3 – Funnel plot of publication bias among studies evaluating the likelihood of presenting with HER2-positive subtype among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.111

**Supplementary Figure 4 – Funnel plot of publication bias among studies evaluating the likelihood of presenting with triple-negative subtype / basal-like subtype among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.594

**Supplementary Figure 5 – Funnel plot of publication bias among studies evaluating the likelihood of presenting with Luminal A-like subtype among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.865

**Supplementary Figure 6 – Funnel plot of publication bias among studies evaluating the likelihood of presenting with Luminal B-like subtype among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.530

**Supplementary Figure 7 – Funnel plot of publication bias among studies evaluating the likelihood of presenting with HER2-enriched subtype among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.767

**Supplementary Figure 8 – Funnel plot of publication bias among studies evaluating adjusted Overall Survival among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.936

**Supplementary Figure 9 – Funnel plot of publication bias among studies evaluating unadjusted Overall Survival among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.201

**Supplementary Figure 10 – Funnel plot of publication bias among studies evaluating the likelihood of presenting with each stage (0/I, II, III and IV) among WLWH compared with HIV-negative women with breast cancer.**



Egger’s test: p=0.843

**Supplementary Figure 11 – Funnel plot of publication bias among studies evaluating the likelihood of presenting with estrogen receptor-positive status among WLWH compared with HIV-negative women with breast cancer.**

Egger’s test: p=0.047

**Supplementary Table 2** **– Sensitivity analysis of the odds of presenting with locally advanced/metastatic stage (III/IV) at diagnosis among WLWH compared with HIV-negative women with breast cancer (all studies).**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I-squared (%)** | **I-sq. P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Sseggwanyi 2011 | 1.40 | 1.21-1.64 | <0.001 | 47.5 | 0.025 |
| Cubasch 2013 | 1.47 | 1.26-1.72 | <0.001 | 44.5 | 0.037 |
| Shiels 2015 | 1.37 | 1.15-1.64 | <0.001 | 48.1 | 0.023 |
| Traore 2015 | 1.42 | 1.21-1.67 | <0.001 | 52.8 | 0.011 |
| Langenhoven 2016 | 1.41 | 1.20-1.66 | <0.001 | 52.5 | 0.011 |
| Phakathi 2016 | 1.43 | 1.21-1.68 | <0.001 | 52.7 | 0.011 |
| Ngidi 2017 | 1.42 | 1.21-1.66 | <0.001 | 51.6 | 0.013 |
| Presti 2017 | 1.42 | 1.20-1.67 | <0.001 | 52.7 | 0.011 |
| McKenzie 2018 | 1.46 | 1.25-1.71 | <0.001 | 47.6 | 0.024 |
| Van Zyl 2018 | 1.44 | 1.22-1.69 | <0.001 | 51.9 | 0.012 |
| Ayeni 2019 | 1.51 | 1.31-1.74 | <0.001 | 30.3 | 0.134 |
| Brandao 2019 | 1.41 | 1.20-1.67 | <0.001 | 52.6 | 0.011 |
| Coghill 2019 | 1.37 | 1.15-1.62 | <0.001 | 37.2 | 0.079 |
| Phakathi 2019 | 1.42 | 1.19-1.69 | <0.001 | 52.7 | 0.011 |
| Sadigh 2019 | 1.46 | 1.25-1.72 | <0.001 | 47.0 | 0.027 |

CI: confidence interval; OR: odds ratio.

**Supplementary Table 3** **– Sensitivity analysis of the odds of presenting with locally advanced/metastatic stage (III/IV) at diagnosis among WLWH compared with HIV-negative women with breast cancer (North American studies).**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Shiels 2015 | 1.75 | 1.54-1.98 | <0.001 | 0.0 | 0.891 |
| Presti 2017 | 1.76 | 1.58-1.96 | <0.001 | 0.0 | 0.895 |
| Coghill 2019 | 1.77 | 1.46-2.14 | <0.001 | 0.0 | 0.859 |

CI: confidence interval; OR: odds ratio.

**Supplementary Table 4** **– Sensitivity analysis of the odds of presenting with locally advanced/metastatic stage (III/IV) at diagnosis among WLWH compared with HIV-negative women with breast cancer (Sub-Saharan African studies).**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I-squared (%)** | **I-sq. P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Sseggwanyi 2011 | 1.20 | 1.05-1.39 | 0.010 | 0.0 | 0.711 |
| Cubasch 2013 | 1.27 | 1.07-1.50 | 0.005 | 6.8 | 0.379 |
| Traore 2015 | 1.24 | 1.06-1.45 | 0.008 | 11.1 | 0.339 |
| Langenhoven 2016 | 1.21 | 1.05-1.40 | 0.010 | 3.1 | 0.413 |
| Phakathi 2016 | 1.23 | 1.05-1.45 | 0.010 | 11.1 | 0.339 |
| Ngidi 2017 | 1.22 | 1.06-1.41 | 0.006 | 3.0 | 0.414 |
| McKenzie 2018 | 1.26 | 1.07-1.48 | 0.005 | 7.6 | 0.372 |
| Van Zyl 2018 | 1.24 | 1.06-1.46 | 0.008 | 11.8 | 0.332 |
| Ayeni 2019 | 1.30 | 1.10-1.54 | 0.002 | 0.0 | 0.460 |
| Brandao 2019 | 1.22 | 1.05-1.41 | 0.011 | 4.8 | 0.397 |
| Phakathi 2019 | 1.16 | 0.99-1.36 | 0.059 | 0.0 | 0.493 |
| Sadigh 2019 | 1.26 | 1.07-1.48 | 0.005 | 7.5 | 0.373 |

CI: confidence interval; OR: odds ratio.

**Supplementary Table 5** **– Sensitivity analysis of the odds of presenting with ER-positive/HER2-negative subtype among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Cubasch 2013 | 0.77 | 0.60-0.97 | 0.030 | 0.0 | 0.630 |
| Langenhoven 2016 | 0.79 | 0.64-0.97 | 0.028 | 0.0 | 0.636 |
| Van Zyl 2018 | 0.81 | 0.66-1.00 | 0.050 | 0.0 | 0.506 |
| Bhatia 2019 | 0.82 | 0.66-1.01 | 0.057 | 0.0 | 0.530 |
| Brandao 2019 | 0.79 | 0.64-0.98 | 0.030 | 0.0 | 0.615 |
| Phakathi 2019 | 0.93 | 0.71-1.23 | 0.624 | 0.0 | 0.924 |

CI: confidence interval; OR: odds ratio.

**Supplementary Table 6 – Sensitivity analysis of the odds of presenting with HER2-positive subtype among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Cubasch 2013 | 0.99 | 0.64-1.53 | 0.958 | 43.5 | 0.115 |
| Langenhoven 2016 | 1.12 | 0.78-1.61 | 0.523 | 40.5 | 0.135 |
| Ngidi 2017 | 1.15 | 0.84-1.58 | 0.381 | 34.1 | 0.180 |
| Van Zyl 2018 | 1.04 | 0.72-1.51 | 0.819 | 44.5 | 0.109 |
| Bhatia 2019 | 1.06 | 0.74-1.51 | 0.759 | 44.8 | 0.107 |
| Brandao 2019 | 1.29 | 1.02-1.62 | 0.032 | 0.0 | 0.687 |
| Phakathi 2019 | 0.97 | 0.64-1.48 | 0.895 | 35.1 | 0.173 |

CI: confidence interval; OR: odds ratio.

**Supplementary Table 7 – Sensitivity analysis of the odds of presenting with triple-negative subtype / basal-like subtype among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Cubasch 2013 | 1.26 | 0.98-1.64 | 0.076 | 0.0 | 0.737 |
| Langenhoven 2016 | 1.15 | 0.89-1.47 | 0.279 | 6.9 | 0.376 |
| Presti 2017 | 1.10 | 0.86-1.39 | 0.453 | 0.0 | 0.502 |
| Van Zyl 2018 | 1.16 | 0.91-1.47 | 0.237 | 3.0 | 0.403 |
| Bhatia 2019 | 1.14 | 0.89-1.45 | 0.306 | 6.6 | 0.378 |
| Brandao 2019 | 1.07 | 0.84-1.36 | 0.576 | 0.0 | 0.705 |
| Phakathi 2019 | 1.10 | 0.83-1.46 | 0.519 | 3.3 | 0.400 |
| Sadigh 2019 | 1.17 | 0.90-1.51 | 0.233 | 3.5 | 0.399 |

CI: confidence interval; OR: odds ratio.

**Supplementary Figure 12 – Meta-analysis of the odds of presenting with stage 0/I at diagnosis among WLWH compared with HIV-negative women with breast cancer.**



OR (95% CI)

Random effect: p<0.001. CI=confidence interval; OR=odds ratio.

**Supplementary Table 8 – Sensitivity analysis of the odds of presenting with stage 0/I at diagnosis among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Sseggwanyi 2011 | 0.66 | 0.59-0.74 | <0.001 | 0.0 | 0.764 |
| Cubasch 2013 | 0.66 | 0.59-0.74 | <0.001 | 0.0 | 0.866 |
| Langenhoven 2016 | 0.66 | 0.59-0.74 | <0.001 | 0.0 | 0.851 |
| Phakathi 2016 | 0.67 | 0.59-0.74 | <0.001 | 0.0 | 0.763 |
| Presti 2017 | 0.66 | 0.59-0.74 | <0.001 | 0.0 | 0.768 |
| Brandao 2019 | 0.66 | 0.59-0.74 | <0.001 | 0.0 | 0.764 |
| Coghill 2019 | 0.66 | 0.46-0.94 | 0.022 | 0.0 | 0.757 |
| Phakathi 2019 | 0.67 | 0.60-0.75 | <0.001 | 0.0 | 0.959 |
| Sadigh 2019 | 0.67 | 0.60-0.75 | <0.001 | 0.0 | 0.798 |

CI: confidence interval; OR: odds ratio.

**Supplementary Figure 13 – Meta-analysis of the odds of presenting with stage II at diagnosis among WLWH compared with HIV-negative women with breast cancer.**



OR (95% CI)

Random effect: p=0.146. CI=confidence interval; OR=odds ratio.

**Supplementary Table 9** **– Sensitivity analysis of the odds of presenting with stage II at diagnosis among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Sseggwanyi 2011 | 0.96 | 0.86-1.06 | 0.438 | 0.9 | 0.426 |
| Cubasch 2013 | 0.85 | 0.68-1.05 | 0.133 | 36.7 | 0.125 |
| Langenhoven 2016 | 0.91 | 0.78-1.07 | 0.266 | 21.2 | 0.255 |
| Phakathi 2016 | 0.87 | 0.71-1.05 | 0.145 | 36.6 | 0.125 |
| Ngidi 2017 | 0.89 | 0.75-1.05 | 0.176 | 29.2 | 0.185 |
| Presti 2017 | 0.86 | 0.71-1.04 | 0.128 | 36.7 | 0.125 |
| Brandao 2019 | 0.90 | 0.76-1.07 | 0.232 | 27.3 | 0.201 |
| Coghill 2019 | 0.82 | 0.66-1.01 | 0.057 | 14.1 | 0.317 |
| Phakathi 2019 | 0.88 | 0.72-1.09 | 0.240 | 29.4 | 0.183 |
| Sadigh 2019 | 0.84 | 0.69-1.03 | 0.088 | 34.5 | 0.142 |

CI: confidence interval; OR: odds ratio.

**Supplementary Figure 14 – Meta-analysis of the odds of presenting with stage III at diagnosis among WLWH compared with HIV-negative women with breast cancer.**



OR (95% CI)

Random effect: p<0.001. CI=confidence interval; OR=odds ratio.

**Supplementary Table 10 – Sensitivity analysis of the odds of presenting with stage III at diagnosis among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Sseggwanyi 2011 | 1.24 | 1.10-1.39 | <0.001 | 0.0 | 0.603 |
| Cubasch 2013 | 1.27 | 1.11-1.46 | 0.001 | 4.2 | 0.400 |
| Langenhoven 2016 | 1.26 | 1.11-1.43 | <0.001 | 3.0 | 0.409 |
| Phakathi 2016 | 1.23 | 1.07-1.43 | 0.005 | 13.1 | 0.325 |
| Ngidi 2017 | 1.24 | 1.11-1.40 | <0.001 | 0.0 | 0.481 |
| Presti 2017 | 1.23 | 1.07-1.41 | 0.003 | 8.4 | 0.366 |
| Brandao 2019 | 1.25 | 1.10-1.44 | 0.001 | 6.7 | 0.379 |
| Coghill 2019 | 1.20 | 0.99-1.45 | 0.065 | 9.0 | 0.361 |
| Phakathi 2019 | 1.21 | 1.03-1.42 | 0.017 | 9.0 | 0.360 |
| Sadigh 2019 | 1.28 | 1.13-1.44 | <0.001 | 0.0 | 0.466 |

CI: confidence interval; OR: odds ratio.

**Supplementary Figure 15 – Meta-analysis of the odds of presenting with stage IV at diagnosis among WLWH compared with HIV-negative women with breast cancer.**



OR (95% CI)

Random effect: p=0.009. CI=confidence interval; OR=odds ratio.

**Supplementary Table 11** **– Sensitivity analysis of the odds of presenting with stage IV at diagnosis among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Sseggwanyi 2011 | 1.56 | 1.10-2.23 | 0.013 | 65.2 | 0.003 |
| Cubasch 2013 | 1.70 | 1.19-2.42 | 0.003 | 57.3 | 0.016 |
| Langenhoven 2016 | 1.49 | 1.02-2.17 | 0.039 | 64.6 | 0.004 |
| Phakathi 2016 | 1.58 | 1.10-2.27 | 0.013 | 65.7 | 0.003 |
| Ngidi 2017 | 1.61 | 1.14-2.29 | 0.007 | 64.1 | 0.004 |
| Presti 2017 | 1.60 | 1.10-2.31 | 0.013 | 65.3 | 0.003 |
| Brandao 2019 | 1.55 | 1.05-2.29 | 0.026 | 65.8 | 0.003 |
| Coghill 2019 | 1.32 | 1.04-1.69 | 0.023 | 0.0 | 0.523 |
| Phakathi 2019 | 1.71 | 1.21-2.42 | 0.002 | 47.3 | 0.056 |
| Sadigh 2019 | 1.68 | 1.16-2.42 | 0.006 | 58.6 | 0.013 |

CI: confidence interval; OR: odds ratio.

**Supplementary Figure 16 – Meta-analysis of the odds of presenting with Luminal A-like subtype among WLWH compared with HIV-negative women with breast cancer.**



OR (95% CI)

Random effect: p=0.059. CI=confidence interval; OR=odds ratio.

**Supplementary Table 12** **– Sensitivity analysis of the odds of presenting with Luminal A-like subtype among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Presti 2017 | 0.76 | 0.50-1.15 | 0.193 | 0.0 | 0.403 |
| Van Zyl 2018 | 0.68 | 0.38-1.22 | 0.200 | 47.6 | 0.148 |
| Brandao 2019 | 0.60 | 0.41-0.87 | 0.007 | 0.0 | 0.422 |
| Phakathi 2019 | 0.63 | 0.29-1.33 | 0.226 | 44.4 | 0.165 |

CI: confidence interval; OR: odds ratio.

**Supplementary Figure 17 – Meta-analysis of the odds of presenting with Luminal B-like subtype among WLWH compared with HIV-negative women with breast cancer.**



OR (95% CI)

Random effect: p=0.800. CI=confidence interval; OR=odds ratio.

**Supplementary Table 13** **– Sensitivity analysis of the odds of presenting with Luminal B-like subtype among HIV-positive compared with HIV-negative breast cancer patients.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Presti 2017 | 1.01 | 0.77-1.32 | 0.962 | 0.0 | 0.542 |
| Van Zyl 2018 | 1.00 | 0.75-1.32 | 0.987 | 0.0 | 0.539 |
| Brandao 2019 | 1.09 | 0.82-1.45 | 0.561 | 0.0 | 0.587 |
| Phakathi 2019 | 1.09 | 0.68-1.74 | 0.731 | 0.0 | 0.405 |

CI: confidence interval; OR: odds ratio.

**Supplementary Figure 18 – Meta-analysis of the odds of presenting with HER2-enriched subtype among WLWH compared with HIV-negative women with breast cancer.**



OR (95% CI)

Random effect: p=0.842. CI=confidence interval; OR=odds ratio.

**Supplementary Table 14** **– Sensitivity analysis of the odds of presenting with HER2-enriched subtype among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Presti 2017 | 0.83 | 0.37-1.87 | 0.650 | 42.0 | 0.178 |
| Van Zyl 2018 | 0.99 | 0.34-2.93 | 0.992 | 69.2 | 0.039 |
| Brandao 2019 | 1.34 | 0.81-2.22 | 0.261 | 0.3 | 0.367 |
| Phakathi 2019 | 1.03 | 0.27-3.99 | 0.966 | 70.5 | 0.034 |

CI: confidence interval; OR: odds ratio.

**Supplementary Figure 19 – Meta-analysis of the odds of presenting with estrogen receptor-positive status among WLWH compared with HIV-negative women with breast cancer.**



OR (95% CI)

Random effect: p=0.112. CI=confidence interval; OR=odds ratio.

**Supplementary Table 15** **– Sensitivity analysis of the odds of presenting with estrogen receptor-positive status among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled OR** | **95% CI** | **P-value** |
| Cubasch 2013 | 0.77 | 0.59-0.99 | 0.043 | 16.9 | 0.297 |
| Langenhoven 2016 | 0.84 | 0.65-1.09 | 0.197 | 28.4 | 0.201 |
| Ngidi 2017 | 0.88 | 0.72-1.08 | 0.227 | 5.1 | 0.391 |
| Presti 2017 | 0.89 | 0.72-1.10 | 0.301 | 6.8 | 0.378 |
| Van Zyl 2018 | 0.79 | 0.61-1.03 | 0.081 | 31.0 | 0.181 |
| Bhatia 2019 | 0.84 | 0.66-1.07 | 0.165 | 28.3 | 0.203 |
| Brandao 2019 | 0.80 | 0.61-1.06 | 0.117 | 34.7 | 0.151 |
| Phakathi 2019 | 0.78 | 0.58-1.06 | 0.112 | 34.1 | 0.156 |
| Sadigh 2019 | 0.79 | 0.59-1.04 | 0.091 | 32.9 | 0.165 |

CI: confidence interval; OR: odds ratio.

**Supplementary Table 16 – Sensitivity analysis of adjusted Overall Survival among WLWH compared with HIV-negative women with breast cancer (North American studies).**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled HR** | **95% CI** | **P-value** |
| Biggar 2005 | 2.85 | 1.11-7.30 | 0.029 | 99.0 | <0.001 |
| Coghill 2015 | 1.77 | 1.62-1.93 | <0.001 | 0.0 | 0.816 |
| Coghill 2019 | 2.96 | 1.06-8.25 | 0.038 | 82.8 | 0.016 |

CI: confidence interval; HR: hazard ratio.

**Supplementary Table 17** **– Sensitivity analysis of adjusted Overall Survival among WLWH compared with HIV-negative women with breast cancer (Sub-Saharan African studies).**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled HR** | **95% CI** | **P-value** |
| Coghill 2013 | 1.51 | 1.14-2.00 | 0.004 | 23.0 | 0.273 |
| Cubasch 2018 | 1.59 | 1.16-2.19 | 0.004 | 24.1 | 0.268 |
| Brandao 2019 | 1.72 | 1.33-2.22 | <0.001 | 0.0 | 0.641 |
| Sadigh 2019 | 1.35 | 0.97-1.88 | 0.074 | 0.0 | 0.527 |

CI: confidence interval; HR: hazard ratio.

**Supplementary Figure 20 – Meta-analysis of unadjusted overall survival among WLWH compared with HIV-negative women with breast cancer.**



HR (95% CI)

Random effect: p=0.019. CI=confidence interval; HR=hazard ratio.

**Supplementary Table 18** **– Sensitivity analysis of unadjusted Overall Survival among WLWH compared with HIV-negative women with breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study excluded** | **Random effect** | **I2 (%)** | **I2 P-value** |
| **Pooled HR** | **95% CI** | **P-value** |
| Cubasch 2018 | 1.61 | 1.22-2.12 | 0.001 | 7.2 | 0.299 |
| Brandao 2019 | 1.44 | 0.89-2.31 | 0.136 | 65.0 | 0.091 |
| Sadigh 2019 | 1.20 | 0.86-1.67 | 0.277 | 0.0 | 0.570 |

CI: confidence interval; HR: hazard ratio.

**Supplementary Table 19 – Sensitivity analysis of adjusted and unadjusted Overall Survival (OS) among WLWH compared with HIV-negative women with breast cancer, excluding studies with poor-quality follow-up.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Adjusted OS** |  |  |  |
| **Studies excluded** | **Random effect** | **I-squared (%)** | **I-sq. P-value** |
| **HR** | **95% CI** | **P-value** |
| Coghill 2013 & Cubasch 2018 | 1.50 | 0.96-2.36 | 0.077 | 58.1 | 0.122 |
| **Unadjusted OS** |  |  |  |
| **Study excluded** | **Random effect** | **I-squared (%)** | **I-sq. P-value** |
| **HR** | **95% CI** | **P-value** |
| Cubasch 2018 | 1.61 | 1.22-2.12 | 0.001 | 7.2 | 0.299 |

CI: confidence interval; HR: hazard ratio.

**Supplementary Table 20** **– Age at diagnosis and anti-cancer treatment received by WLWH and HIV-negative women with breast cancer in each of the included studies.**

|  |  **Age at diagnosis** | **Anti-cancer treatment received by WLWH (n, %)** | **Anti-cancer treatment received by HIV-negative women (n, %)** |
| --- | --- | --- | --- |
| **Author (Year)** | **WLWH** | **HIV-negative women** | **Total nb pts** | **Any tx received** | **Surgery** | **CT** | **Comple-ting CT** | **RT** | **Total nb pts** | **Any tx received** | **Surgery** | **CT** | **Comple-ting CT** | **RT** |
| Biggar et al (2005)[1] | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Sseggwanyi et al (2011)[2] | Mean: 32.4 (range 18-52) | Mean: 45.0 (range 21-80) | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Coghill et al (2013)[3] | NR¥ | NR¥ | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Cubasch et al (2013)[4] | NR¥ | NR¥ | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Cubasch et al (2018)[5] | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Shiels et al (2015)[6] | NR¥ | NR¥ | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Coghill et al (2015)[7] | NR¥ | NR¥ | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Traore et al (2015)[8] | Median: 36.5 (range 26-58) | Median: 49.0 (range 20-85) | 14 | 7 (50%) | 3 (21%) | 6 (43%) | NR | NR | 264 | 202 (77%) | NR | NR | NR | NR |
| Phakathi et al (2016)[9] | Median: 41.0 (SD 8.6) | Median: 55.0 (SD 13.9) | 31 | NR | 29 (94%) | 27 (87%) | 25 (93%) | 14 (45%) | 129 | NR | 124 (96%) | 113 (88%) | 106 (94%) | 41 (32%) |
| Langenhoven et al (2016)[10] | Median: 42.0 (range 29-60) | Median: 54.0 (range 20-91) | 31 | NR | NR | 19 (61%) | 16 (84%) | NR | 39 | NR | NR | 39 (100%) | 33 (85%) | NR |
| Ngidi et al (2017)[11] | Mean: 40.6 (SD 9.6) | Mean: 52.0 (SD 13.1) | 21 | NR | NR | 21 (all) | 20 (95%) | NR | 44 | NR | NR | 44 (100%) | 44 (100%) | NR |
| Presti et al (2017)[12] | Mean: 53.2 (SD 9.5) | Mean: 60.6 (SD: NR) | 43 | NR | 38 (88%) | 26 (61%) | NR | 30 (70%) | 3012 | NR | 2697 (90%) | 1273 (43%) | NR | 1869 (62%) |
| McKenzie et al (2018)[13] | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Van Zyl et al (2018)[17] | Mean: 44.9 (SD 9) | Mean: 53.2 (SD 12.5) | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Sadigh et al (2019)[18] | Median: 47.2 (IQR 41-54) | Median: 55.9 (IQR 45-66) | 151 | NR | 111 (76%) | 76 (50%) | NR | 64 (43%) | 327 | NR | 262 (82%) | 147 (45%) | NR | 166 (50%) |
| Brandao et al (2019)[19] | Mean: 45.2 (SD 10.1) | Mean: 50.8 (SD 14.3) | 52 | 52 (100%) | 41 (79%) | 49 (94%) | 35 (71%) | 0 | 152 | 148 (97%) | 125 (82%) | 143 (94%) | 103 (73%) | 9 (6%) |
| Phakathi et al (2019)[20] | Median: 45.0 (IQR 40-52) | Median: 57.0 (46-67) | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Bhatia et al (2019)[21] | NR¥ | NR¥ | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Ayeni et al (2019)[22] | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Coghill et al (2019)[23]\* | NR¥ | NR¥ | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |

Legend: CT=chemotherapy; IQR=interquartile range; NR=not reported; RT=radiotherapy; SD=standard deviation; tx=treatment; WLWH=women living with HIV.

¥Not reported as a continuous variable, but in categories. \*Overall (all tumor types): Receipt of surgery, radiotherapy or chemotherapy among HIV-positive patients: 11,598 (80.2%) vs. among HIV-negative: 5,747,187 (90.3%).

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