Breast self-examination practice among women in Africa: a systematic review and Meta-analysis

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Abstract

Background: In resource limited countries breast self-examination has been recommended as the most appropriate method for early detection of breast cancer. Available studies conducted on breast self-examination practice in Africa currently are inconsistent and inclusive evidences. On top of that the available studies are unrepresentative by regions with small sample size. Therefore, this systematic review and meta-analysis were conducted to summarize and pool the results of individual studies to produce content level estimates of breast self-examination practice in Africa.

Methods: A systematic review and meta-analysis were done among studies conducted in Africa using Preferred Item for Systematic Review and Meta-analysis (PRISMA) guideline. Studies were identified from PubMed, Google Scholar, HINARI, EMBASE, CINAHL, Cochrane, African Journals Online and reference lists of identified prevalence studies. Unpublished sources were also searched to retrieve relevant articles. Critical appraisal of studies was done through Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI). The meta-analysis was conducted using STATA 13 software. Heterogeneity was assessed using I² statistics while publication was assessed through funnel plot. Forest plot were used to present the pooled prevalence with a 95% confidence interval (CI) using the random effect model.

Results: In this meta-analysis 56 studies were included with a total of 19,228 study participants. From the included studies 25(44.64%) were from West Africa, 22(39.29%) East Africa, 5(8.93%) North Africa, 3(5.36%) Central Africa and 1(1.79%) South Africa. The overall pooled prevalence of ever and regular breast self-examination practice in Africa was found to be 44.0% (95% CI: 36.63, 51.50) and 17.9% (95% CI: 13.36, 22.94) respectively. In the subgroup analysis there was significant variations between sub regions with the highest practice in West Africa, 58.87% (95 CI%: 48.06, 69.27) and the lowest in South Africa, 5.33% (95 CI%: 2.73, 10.17).

Conclusion: This systematic review and meta-analysis revealed that breast self-examination practice among women in Africa was low. Therefore, intensive behavioral change communication and interventions that emphasize different domains should be given by stakeholders.

PROSPERO registration number: CRD42020119373.

Keywords: Breast self-examination, Prevalence, Women, Africa, Systematic review, Meta-analysis
Background
Breast cancer is the most commonly diagnosed cancer in women and the leading cause of cancer death worldwide, with an estimated 1.7 million new cases and 521,900 deaths in 2012 compared to 1.38 million new cases and 458,000 deaths in 2008 [1–3]. Based on Global Cancer Observatory (GLOBOCAN) estimates, about 14.1 million new cancer cases and 8.2 million deaths occurred in 2012 worldwide [3].

The burden of cancer has shifted to low and middle income countries (LMIC), which currently account for about 57% of cases and 65% of cancer deaths worldwide [3]. Nearly 60% of deaths due to breast cancer occur in LMIC [4]. Recent global cancer statistics indicated that breast cancer incidence is rising at a faster rate in populations of LMIC [5, 6]. The age-standardized incidence rates of breast cancer incidence for the year 2012 in Africa regions were estimated as; 30.4 in eastern Africa (per 100,000 women per year), 26.8 in middle Africa, 38.6 in western Africa, 38.9 in southern Africa and, 33.8 in sub-Saharan Africa [1, 7, 8]. Mortality and morbidity of breast cancer is emerging as a major public health concerns in many LMICs [9]. The lifetime risk of a woman getting breast cancer is 1 in 10 [10]. The main reason for increasing mortality is mainly due to late diagnosis of the disease and lack of feasible early screening programs [11, 12].

Early diagnosis and survival improvement of breast cancer is a top priority to reduce the increasing mortality rate, projected to reach 112, 000 deaths in 2040 [13]. Detecting and preventing breast cancer at an early stage through feasible screening approaches is a very essential recommendation to meet sustainable development goal (SDG) 3.4 by 2030 [14]. Breast cancer is curable if detected early through screening and early diagnosis by breast self-examination (BSE), clinical breast examination (CBE), and mammography [15]. Despite the existence of controversies about the effectiveness breast self-examination in reducing mortality and morbidity [16–18], the technique remains an important approach for early detection mainly in low and middle-income countries where access to diagnostic and curative facilities may be problematic [19, 20].

Breast self-examination practice is the recommended approach in developing countries because it is easy to perform, feasible, convenient, safe and requires no specific equipment and set up [21–23]. Despite this recommendation, available studies conducted on breast self-examination practice in Africa currently are inconsistent and inclusive to inform and direct stakeholders. On top of that the available reviews lacks comprehensives since they were limited to country level with small sample size and high heterogeneity in their results. Therefore, this systematic review and meta-analysis were conducted to summarize and pool the results of individual studies to produce continent level estimates of breast self-examination practice in Africa. The finding of the study will be contributing for designing feasible strategies, policies and guidelines to improve breast self-examination practice and also to fight against breast cancer among women in Africa.

Methods
Search strategy
This systematic review and meta-analysis was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement guideline. Pertinent published articles were searched in the following electronic bibliographic databases: PubMed, EMBASE, Science Direct, HINARI, Google scholar, WHO Global Index Medicus and African Journals Online (AJOL) were searched to retrieve all available studies. In addition, cross-references of included studies were hand-searched as well to access additional relevant articles that may have been missed in the search. We used Medical Subject Heading (MeSH) and keywords to identify relevant studies from the respective database. The search terms were used separately and together using Boolean operators “OR” or “AND”. The key word of search strategy used to retrieve relevant articles was as follows: (((“Breast Self Examination”[MeSH Terms] OR “self examination breast” OR “early detection of breast cancer” OR “breast cancer screening”)) AND (“health knowledge, attitudes, practice”[MeSH Terms])) AND (“women”[MeSH Terms] OR “Girls” OR “Woman” OR “female” OR “females” OR “Reproductive age women” OR “reproductive aged women”)) AND (“Africa”[MeSH Terms] OR (((“Africa central” OR “Africa eastern” OR “Africa southern” OR “Africa western” OR “Africa northern”)). The software EndNote version X8 (Tomson Reuters, New York, NY) was used to manage references and remove duplicated references. All articles published up to June 30, 2020 in English language were included in the review if fulfilled the eligibility criteria. This systematic review and meta-analysis was registered in PROSPERO with a registration number; http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42020119373

Eligibility criteria
Inclusion criteria

Study design Observational (case-control, cohort, cross-sectional) studies reporting breast self-examination practice among women in Africa were included.

Study area Only studies conducted in Africa continent were included.
Language Studies that were conducted only in English language were included.

Publication status Both published and unpublished articles were included.

Publication period All publication reported up to June 30, 2020 were included.

Population Studies which were conducted among women in Africa.

Outcome Women who have ever/regularly performed breast self-examination for detection of breast abnormalities and lumps.

Exclusion criteria Studies were excluded if they were not primary studies (such as review articles, conference abstract, editorials, case reports am expert opinion). Moreover, studies not reporting the outcome variable, published in any language other than English, author contact not replied within 3 weeks, and qualitative studies were excluded.

Study selection First, articles were assessed for inclusion through a title and abstract review by two independent reviewers. Second, potentially-eligible studies were undergoing full-text review to determine if they satisfy the criteria set for inclusion. We did a full-text review in duplicate and clearly document reasons for inclusion and exclusion. Finally, data were extracted from all articles that meet the inclusion criteria. The data extraction form was pre-tested with 3–5 eligible studies. The practice of breast self-examination was extracted if only reported and/or estimated based on experts’ opinion or previously published studies or guidelines. In case of incomplete data, the corresponding author(s) were contacted to find full information. Disagreement and unclear information in the selection of articles being included in the review were resolved through discussion and consensus.

In our search we identified 829 articles from different electronic databases. From these, 701 were found duplicate records and removed from the review. Fifty-one and thirteen articles were excluded by reviewing the title and abstract respectively. After a full review of articles, eight were excluded. Three studies didn’t fulfill the inclusion criteria, one articles fail to report the outcome variables and four articles unable to get access to the full articles. Finally, 56 were found to be eligible and included in this meta-analysis (Fig. 1).

Outcome measures The primary outcome variable of this study is breast self-examination practice (ever/regular) among women in Africa. Ever breast self-examination practice is defined as a woman who performed breast self-examination irregularly for the purpose of detecting and feeling any abnormal swelling or lumps in their breast tissue which was assessed through interview administered questionnaires. Regular breast self-examination practice when a woman performed breast self-examination during men- ses once per month which was assessed through interview administered questionnaires.

Quality assessment Quality assessment was conducted based on Hoy 2012 tool by two reviewers using 10 criteria addressing internal and external validity [24]. The items included the following ten parameters: (1) representation of the population, (2) sampling frame, (3) methods of participants’ selection, (4) non-response bias, (5) data collection directly from subjects, (6) was an acceptable case definition used, (7) was tool shown reliability and validity, (8) was the same mode of data collection used, (9) was the length of prevalence period appropriate, and (10) were the numerator and denominator appropriate. Each item was assessed as either low or high risk of bias. Unclear was regarded as high risk of bias. In this study, each of the ten parameters in the risk of bias tool was allocated an equal weight. Therefore, the overall assessment of bias was ultimately dependent on the number of high risk parameters out of the ten parameters in the included studies. Finally, the overall risk of bias was graded as high quality (≥ 2), medium quality [3, 4], and low quality (≥ 5) based on the number of high risk parameters per individual studies (Table 1).

Data extraction Data extraction of included articles was made using the Joanna Briggs Institute (JBI) tool for prevalence studies [25]. A Microsoft excel sheet was prepared and the following information were extracted; author/s name, title, year of publication, study area and country, study design, study setting, study population, age of the study participants, sample size, response rate, prevalence of breast self-examination practice (ever/regular).

Heterogeneity and publication bias The heterogeneity of included studies was assessed by using the $I^2$ statistics. The $p$-value for $I^2$ statistics less than 0.05 were used to determine the presence of heterogeneity. $I^2$ values of 25, 50, and 75% are assumed to represent low, moderate and high heterogeneity respectively [26]. Graphically publication bias and small study effect were evaluated by funnel plot test. We had plotted
the studies’ logit event rate and standard error to detect asymmetry in the distribution. When there is a gap in the funnel plot, it indicates that is a potential for publication bias. In addition, the publication bias was assessed using the Egger regression asymmetry test [27].

**Statistical analysis and synthesis**

Findings were illustrated in the form of forest plots and tables. Eligible primary studies data were extracted, entered into Microsoft Excel and then exported to STATA version 13. Forest plot was used to present the combined estimate with 95% confidence interval (CI) of the meta analysis in Africa. The random effect model of analysis was used as a method of meta-analysis since it enables us to minimize the heterogeneity of included studies. Subgroup and sensitivity analyses were also conducted by different study characteristics such as sub-regions of Africa (East, South, West, Central and Northern Africa), study period (2000–2005, 2006–2010, 2011–2015, 2016–2020), setting (community/institution based), study area (urban, rural or both), study participants’ profession (health/non health professionals), and risk of bias (low, moderate and high).
| Study                     | Representation | Sampling | Random selection | Non response bias | Data collection | Case Definition | Reliability and validity of study tool | Method of data collection | Prevalence period | Numerator and denominator | Risk of Bias |
|---------------------------|----------------|----------|------------------|-------------------|-----------------|----------------|---------------------------------------|--------------------------|------------------|--------------------------------|-------------|
| Birhane et al.            | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Obaji et al.              | Low risk       | High risk| High risk        | Low risk          | Low risk        | High risk      | Low risk                              | Low risk                 | Low risk         | Low risk                        | Moderate risk|
| Onwere et al.             | High risk      | High risk| High risk        | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Moderate risk|
| Abay et al.               | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Minasie A et al.          | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Abdel Fattah, M et al.    | High risk      | High risk| High risk        | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Moderate risk|
| Abeje et al.              | High risk      | Low risk | High risk        | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Birhane K et al.          | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Carlson-Babila Sama et al.| High risk      | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Unclear                  | Low risk         | Low risk                        | Low risk     |
| Kasahun AF                | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | High risk                | Low risk         | Low risk                        | Low risk     |
| Dagne AH et al.           | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Dadzi R, Adam A           | Low risk       | Low risk | High risk        | Low risk          | Low risk        | Unclear       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Gwarzo, UMD et al.        | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Isara, A. R. and QedoKun, C I | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Unclear                  | Low risk         | Low risk                        | Low risk     |
| Segni, MT et al.          | High risk      | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Unclear                  | Low risk         | Low risk                        | Low risk     |
| Azage M. et al.           | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Unclear       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Elshamy, Karima F et al   | High risk      | High risk| High risk        | Low risk          | Low risk        | Low risk       | Low risk                              | Unclear                  | Low risk         | Low risk                        | Moderate risk|
| Akhibe, A. O. et al       | High risk      | Low risk | Low risk         | Low risk          | Low risk        | Unclear       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Nde et al.                | High risk      | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Negeri et al.             | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Unclear       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Odusanya et al.           | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Unclear       | High risk                             | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Ogunbode A M              | High risk      | High risk| High risk        | Low risk          | Low risk        | Unclear       | High risk                             | Low risk                 | Low risk         | Low risk                        | High risk    |
| Ossai EN et al.           | High risk      | Low risk | Low risk         | Low risk          | Low risk        | Unclear       | High risk                             | Low risk                 | Low risk         | Low risk                        | Moderate risk|
| Feleke D. et al.          | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Kayode F.O. et al.        | High risk      | High risk| High risk        | Low risk          | Low risk        | Unclear       | Unclear                              | Low risk                 | Low risk         | Low risk                        | High risk    |
| Okobia, Michael N et al.  | Low risk       | Low risk | Low risk         | Low risk          | Low risk        | Low risk       | Low risk                              | Low risk                 | Low risk         | Low risk                        | Low risk     |
| Study                                      | Representation | Sampling | Random selection | Non-response bias | Data collection | Case Definition | Reliability and validity of study tool | Method of data collection | Prevalence period | Numerator and denominator | Risk of Bias |
|-------------------------------------------|----------------|----------|------------------|------------------|----------------|----------------|----------------------------------------|----------------------------|-------------------|------------------------|--------------|
| Getu et al.                               | High risk      | High risk | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Shallo et al.                             | High risk      | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Suh et al                                  | Low risk       | High risk | High risk        | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Illedora, C. O., & Azuike, E. C.          | High risk      | Low risk  | High risk        | High Risk        | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Moderate risk |
| Ameer, K et al                            | High risk      | High risk | High risk        | Low risk         | Low risk       | Unclear        | Low risk                               | Low risk                  | Low risk          | Low risk               | Moderate risk |
| Agboola AOJ et al                         | High risk      | High risk | High risk        | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Moderate risk |
| Amoan, O. E. and Toyobo, O. O             | Low risk       | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Godfrey, Kavende et al                    | Low risk       | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Bayumi E                                  | High risk      | High risk | High risk        | Low risk         | Low risk       | Low risk       | Unclear                               | Low risk                  | Low risk          | Low risk               | High risk     |
| Bellgam H. I. and Buwari Y. D             | Low risk       | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Boulos, Dina NK and Ghali, Ramy R         | High risk      | High risk | High risk        | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Moderate risk |
| E. Kudza et al                            | Low risk       | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Fondjo LA et al                           | Low risk       | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Idris SA et al                            | High risk      | High risk | High risk        | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Unclear           | Low risk               | High risk     |
| Kiffe MM et al                            | Low risk       | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Morse EP et al                             | Low risk       | Low risk  | High risk        | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Ndikubwimana J et al                      | Low risk       | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Obkol R et al                             | High risk      | High risk | High risk        | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Moderate risk |
| Ramathuba, Dorah U et al                  | Low risk       | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Ramon, Lombe Mumba                        | Low risk       | Low risk  | Low risk         | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Florence, Adeyemo O et al                 | Low risk       | Low risk  | High risk        | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Yakubu AA et al                           | Low risk       | Low risk  | High risk        | Low risk         | Low risk       | Unclear       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Andegiorgishet al                         | Low risk       | Low risk  | High risk        | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Low risk      |
| Kimani, SM and Muthumbi, E                | High risk      | High risk | High risk        | Low risk         | Low risk       | Low risk       | Low risk                               | Low risk                  | Low risk          | Low risk               | Moderate risk |
| Study                                      | Representation | Sampling | Random selection | Non response bias | Data collection | Case Definition | Reliability and validity of study tool | Method of data collection | Prevalence period | Numerator and denominator | Risk of Bias |
|-------------------------------------------|----------------|----------|------------------|-------------------|----------------|----------------|---------------------------------------|---------------------------|----------------|----------------------------|---------------|
| Agbonifoh, Julia                          | Low risk       | Low risk | High risk        | Low risk          | Low risk       | Low risk       | Low risk                              | Low risk                  | Low risk       | Low risk                   | Low risk      |
| Casmir, Ebinim                            | Low risk       | Low risk | Low risk         | Low risk          | Low risk       | Low risk       | Low risk                              | Low risk                  | Low risk       | Low risk                   | Low risk      |
| Chikere Ifeanyi et al                     | Low risk       | Low risk | Low risk         | Low risk          | Low risk       | Low risk       | Low risk                              | Low risk                  | Low risk       | Low risk                   | Low risk      |
| Joel Olayiwola                            | Low risk       | Low risk | Low risk         | Low risk          | Low risk       | Low risk       | Low risk                              | Low risk                  | Low risk       | Low risk                   | Low risk      |
| Makanjuola, OJ et al                      | Low risk       | Low risk | Low risk         | Low risk          | Low risk       | Low risk       | Low risk                              | Low risk                  | Low risk       | Low risk                   | Low risk      |
| Okowokere et al                           | Low risk       | Low risk | Low risk         | Low risk          | Low risk       | Low risk       | Low risk                              | Low risk                  | Low risk       | Low risk                   | Low risk      |
| Sambo, MN et al                           | Low risk       | Low risk | Unclear          | Low risk          | Low risk       | Low risk       | Low risk                              | Low risk                  | Low risk       | Low risk                   | Low risk      |
| Author/s          | Year | Sub-region | Study design   | Study setting          | Response rate | Sample size | Event (Ever Practiced) | Prevalence of BSE (%) | Risk of Bias |
|------------------|------|------------|----------------|------------------------|---------------|-------------|------------------------|-----------------------|--------------|
| Birhane et al.   | 2015 | East Africa| Cross sectional| Institution based      | 99.6          | 315         | 38                     | 12                    | Not reported  |
| Obaji et al.     | 2013 | West Africa | Cross sectional | Community Based        | 100           | 238         | 52                     | 21.8                  | 0.24         | Moderate risk |
| Onwere et al.    | 2009 | West Africa | Cross sectional | Institution based      | 100           | 100         | 78                     | 78                    | Moderate risk |
| Abay et al.      | 2018 | East Africa | Cross sectional | Institution based      | 99            | 404         | 26                     | 6.4                   | Low risk     |
| Minasie A et al. | 2017 | East Africa | Cross sectional | Institution based      | 100           | 281         | 128                    | 46.5                  | Low risk     |
| Abdel Fattah, M et al. | 2000 | North Africa | Cross sectional | Institution based      | 100           | 565         | 59                     | 10.4                  | Moderate risk |
| Abeje et al.     | 2019 | East Africa | Cross sectional | Institution based      | 100           | 633         | 154                    | 24.3                  | 10.1         | Low risk     |
| Birhane K et al. | 2017 | East Africa | Cross sectional | Institution based      | 94            | 400         | 113                    | 28.3                  | Low risk     |
| Same, C. B. et al. | 2017 | Central Africa | Cross sectional | Institution based      | 82.1          | 345         | 133                    | 38.5                  | Not reported |
| Kasahun AF       | 2014 | East Africa | Cross sectional | Institution based      | 95.2          | 400         | 62                     | 15.5                  | Low risk     |
| Dagne AH et al.  | 2019 | East Africa | Cross sectional | Institution based      | 100           | 421         | 137                    | 32.5                  | Low risk     |
| Daddi R, Adam A | 2019 | West Africa | Cross sectional | Community Based        | 100           | 385         | 106                    | 27.5                  | Low risk     |
| Gwarzo, UMD et al | 2009 | West Africa | Cross sectional | Institution based      | 100           | 221         | 126                    | 57                    | Low risk     |
| Isara, A. R. and Ojedokun, C. I | 2017 | East Africa | Cross sectional | Institution based      | 100           | 287         | 29                     | 10.1                  | Low risk     |
| Segni, MT et al | 2016 | East Africa | Cross sectional | Institution based      | 100           | 368         | 145                    | 39.4                  | 2.3          | Low risk     |
| Azage M. et al.  | 2013 | East Africa | Cross sectional | Community Based        | 98.01         | 395         | 147                    | 32.2                  | 14.2         | Low risk     |
| Elishamy, Karima F et al | 2010 | North Africa | Cross sectional | Institution based      | 80            | 133         | 75                     | 56.4                  | 10.5         | Moderate risk |
| Akhigbe, A. O. et al | 2009 | West Africa | Cross sectional | Institution based      | 77.8          | 393         | 305                    | 77.6                  | Not reported  |
| Nde et al.       | 2015 | Central Africa | Cross sectional | Institution based      | 91.1          | 166         | 62                     | 37.3                  | 3            | Low risk     |
| Negeri et al.    | 2017 | East Africa | Cross sectional | Institution based      | 95.5          | 300         | 231                    | 77                    | 33.7         | Low risk     |
| Oduzanya et al.  | 2001 | West Africa | Cross sectional | Institution based      | 94            | 188         | 167                    | 88.9                  | 61.7         | Low risk     |
| Ogunbode A M     | 2015 | West Africa | Cross sectional | Institution based      | 100           | 140         | 87                     | 62                    | 7.9          | High risk    |
| Ossai EN et al.  | 2019 | West Africa | Cross sectional | Institution based      | 100           | 365         | 232                    | 63.6                  | 15.9         | Moderate risk |
| Feleke D. et al. | 2019 | East Africa | Cross sectional | Community Based        | 100           | 810         | 70                     | 86                    | Not reported  |
| Kayode F.O. et al. | 2005 | West Africa | Cross sectional | Institution based      | 84            | 341         | 181                    | 53                    | 33.7         | High risk    |
| Okobia, Michael N et al. | 2006 | West Africa | Cross sectional | Community Based        | 95.1          | 1000        | 349                    | 34.9                  | Not reported  |
| Getu et al.      | 2019 | East Africa | Cross sectional | Institution based      | 100           | 407         | 87                     | 21.4                  | 11           | Low risk     |
| Shallo et al.    | 2019 | East Africa | Cross sectional | Institution based      | 87.9          | 340         | 163                    | 47.9                  | 32.4         | Low risk     |
| Suh et al.       | 2012 | Central Africa | Cross sectional | Community Based        | 100           | 120         | 72                     | 60                    | Not reported  |
| Amee, K et al    | 2014 | East Africa | Cross sectional | Institution based      | 100           | 126         | 29                     | 23                    | Not reported  |
| Idefoci, C. O., & Azuike, E. C. | 2018 | West Africa | Cross sectional | Institution based      | 74.3          | 321         | 148                    | 46.1                  | 6.2          | Moderate risk |
| Agboola AOJ et al | 2009 | West Africa | Cross sectional | Institution based      | 100           | 115         | 98                     | 85.2                  | 46.9         | Moderate risk |
| Amoran, O. E. and Toyobo, O. O | 2015 | West Africa | Cross sectional | Community Based        | –             | 495         | 121                    | 24.4                  | 5.23         | Low risk     |
| Godfrey, Katende et al. | 2016 | East Africa | Cross sectional | Institution Based      | 100           | 204         | 89                     | 43.6                  | 19.6         | Low risk     |
| Bayumi E         | 2016 | North Africa | Cross sectional | Institution based      | 100           | 240         | 91                     | 37.9                  | 15.8         | High risk    |
| Belgam H I. amd Buowaiy Y, D | 2012 | West Africa | Cross sectional | Community Based        | 98.7          | 691         | 200                    | 28.9                  | Not reported  |
| Boulou, Dina NK and Ghali, Ranly R. | 2013 | North Africa | Cross sectional | Institution based      | 89.8          | 543         | 40                     | 7.4                   | 1.3          | Moderate risk |
| E. Kudawuuet al. | 2016 | West Africa | Cross sectional | Community Based        | 100           | 170         | 132                    | 77.6                  | 68           | Low risk     |
| Fonfio LA et al. | 2018 | West Africa | Cross sectional | Institution based      | 100           | 1036        | 831                    | 80.2                  | 8.1          | Low risk     |
| Idris SA et al.  | 2013 | North Africa | Cross sectional | Institution based      | 88.9          | 200         | 129                    | 64.5                  | 64.5         | High risk    |
| Kifle MM et al.  | 2016 | East Africa | Cross sectional | Institution based      | 100           | 380         | 51                     | 13.4                  | 5.5          | Low risk     |
| Morse EP et al.  | 2014 | East Africa | Cross sectional | Institution based      | 100           | 225         | 75                     | 33.3                  | 14.2         | Low risk     |
| Ndikubwirmana J et al | 2016 | East Africa | Cross sectional | Institution based      | 94.8          | 229         | 55                     | 24                    | 4.4          | Low risk     |
Characteristics of included studies

A total of 56 studies were included in this meta-analysis. Fourteen African countries were included in this review. From the included studies, 25 (44.64%) were from West Africa [28–52], 22 (39.29%) from East Africa [19, 53–73], 5 (8.93%) from North Africa [21, 74–77], 3 (5.36%) from Central Africa [78, 79], 1 (1.79%) from South Africa [80]. All the included fifty-six studies in this systematic review and meta-analysis conducted in African countries were cross sectional study designs.

The sample size of the included studies ranged from a minimum of 100 in a study conducted in Nigeria [29, 49, 50] to a maximum of 1036 a study conducted in Ghana [44]. A total of 19,228 study participants were included in this review (Table 2). Almost all 55 (98.21%) of the included studies were published on peer reviewed journals while only 1 (1.178%) study was unpublished [58]. Majority 43 (76.79%) of the included studies were institution based while around one forth 13 (23.21%) of the studies were community based [19, 33, 40, 42, 46, 54, 61, 64, 72, 75]. Majority 40 (71.43%) of the study participant were urban residents and the age of the participants ranged from 13 [32] to 85 [42] year-old.

Prevalence of breast self-examination practice in Africa

The pooled prevalence of ever breast self-examination practice in Africa was 44.0% (95% CI: 36.63, 51.50) (Fig. 2). Whereas the pooled prevalence of regular breast self-examination practice was 17.9% (95% CI: 13.36, 22.94) (Fig. 3). The lowest breast self-examination was reported in South Africa 5.3% (95% CI: 2.73, 10.17) [80] and the highest was in Nigeria 100% (95% CI: 98.12, 100.00) [45]. The prevalence of breast self-examination was highest 58.87% (95% CI: 48.06, 69.27) in West Africa followed by Central Africa 44.87% (95% CI: 32.50, 57.57), North Africa 32.63% (95% CI: 12.09–57.46), East Africa 32.18% (95% CI: 23.74, 41.24) and the lowest was in South Africa 5.33% (95% CI: 2.73, 10.17). The I-square test result showed that there was a high heterogeneity among the included studies (I² = 99.10%, p-value = < 0.001). This result is an indicative to use the random effect model and subgroup analysis.

Subgroup analysis

A subgroup analysis was conducted since there was statistically significant heterogeneity, I-square test statistics less than 0.05 (I² = 99.10%, p-value = < 0.001). The purpose of the analysis was to identify the source of heterogeneity so that correct interpretation of the findings is made. We did subgroup meta-analysis of the included studies by sub region, study setting, study period, study participants, place of resident and risk of bias. However, the subgroup analysis found no significant variable which can explain the heterogeneity in this review. Therefore, the heterogeneity can be explained by other factors not included in this review.

The highest prevalence of ever breast self-examination practice was reported in West African countries 58.87%
while the lowest was in South African country’s 5.33% (95%CI: 2.73, 10.17) (Fig. 4). A higher 48.39% (95%CI: 39.39, 57.44) prevalence of breast self-examination among institutional based studies compared with community-based studies 29.95% (95%CI: 21.53, 39.11). In the subgroup analysis by publication period there was irregular trend in the practice of breast self-examination practice. The highest, 61.42% (95%CI: 45.28, 76.39) prevalence of breast self-examination practice was reported during 2006–2010 while the lowest, 38.58% (95%CI: 27.39, 50.42) was in the period of 2011–2015. Breast self-examination practice was higher 63.33% (95% CI: 48.62, 76.88) among health professionals and urban residents 48.55% (95% CI: 39.20, 57.95). The prevalence of breast self-examination among low risk of bias studies was 43.20% (95%CI: 34.53, 52.08) and
54.30 (95%CI: 42.62,65.75) for high risk of bias studies (Table 3).

Sensitivity analysis
Sensitivity analysis was done to assess the effect of each study on the heterogeneity by excluding studies with small sample size (n ≤ 100) and high risk of bias one by one. However, the excluded studies did not brought reduction in the heterogeneity of the estimates (Table 4).

Risk of bias
Studies included in this meta-analysis were assessed for risk of bias by using Hoy 2012 tool [24] (Table 1). From the 56 included studies, 41(73.21%) of them were categorized as low risk [19, 30–33, 38, 41–53, 55–64, 66–69, 71, 72, 78–83], 11(19.64%) moderate risk [28, 29, 36, 39, 40, 55, 70, 73–75, 77] and 4(7.14%) high risk of bias [21, 35, 37, 76]. It is also found that 23(41.1%) and 21(37.5%) of the included studies did not apply random selection and represent the national population respectively.

Publication bias
Small study effect of the included studies was assessed through visually and statistically. In this meta-analysis there was no publication bias since the included studies were distributed symmetrically in the funnel plot (Fig. 5). Additionally, the result of Egger’s test showed that no publication bias (p-value = 0.232).

Discussion
In low and middle income countries, breast self-examination is one of feasible and practical options to screen breast cancer at an early stage [84, 85]. Breast self-examination has shown in reduction of incidence and death, improvement of survival rate and detection of breast cancer at an early stage [86, 87]. This systematic review and meta-analysis is paramount in showing the
status of breast self-examination practice in Africa. This review showed that significant numbers of women in Africa are not practicing breast examination.

In this meta-analysis the overall pooled prevalence of ever breast self-examination practice was 44.0% (95% CI: 36.63, 51.50). The finding was comparable (44.4%) with the results of the Seifu and Mekonen study in the Archives of Public Health in 2021. This highlights the importance of increasing awareness and education on breast self-examination practices among women in Africa to improve cancer detection and survival rates.
a study conducted in Indonesia [88] among women in the age group of 20–60. However, it is higher than a nationwide cancer screening survey in South Korea (16.1%) [89] and Russia (24%) [90]. This discrepancy might be attributed due to difference in the age of the study population. In this meta-analysis majority (67.9%) of the study participant are younger age groups [20–40] and this age groups are more likely to perform breast self-examination than older one [91]. On the other hand, this finding was lower than a study conducted among nurses in Poland (100%) [91] and University staffs in Malaysia 83.7% [92]. This discrepancy might be attributed due to difference in culture and tradition towards breast self-examination in the study population. In addition to this, the level of awareness and information dissemination about breast self-examination frequency and interval is

Table 3 Subgroup analysis of the prevalence of breast self-examination practice in Africa

| Subgroup          | Number of studies | Prevalence BSE Practice (95% CI) | Heterogeneity |
|-------------------|-------------------|---------------------------------|---------------|
|                   |                   |                                 | I²             |
|                   |                   |                                 | p-value       |
| Sub region        |                   |                                 |               |
| West Africa       | 25                | 58.87(48.06, 69.27)             | 99.05         |
| East Africa       | 22                | 32.18 (23.74, 41.24)            | 98.61         |
| North Africa      | 5                 | 32.63(12.09, 57.46)             | 99.02         |
| Central Africa    | 3                 | 44.87(32.50, 57.57)             | –             |
| South Africa      | 1                 | 5.33 (2.73,10.17)               | –             |
| Study participant |                   |                                 |               |
| Health professional | 10               | 63.33(48.62, 76.88)             | 98.56         |
| Non health professionals | 46     | 39.81(31.85, 48.06)             | 99.12         |
| Study setting     |                   |                                 |               |
| Institutional based | 43              | 48.39(39.39,57.44)              | 99.16         |
| Community based   | 13                | 29.95(21.53, 39.11)             | 97.85         |
| Publication Period|                   |                                 |               |
| 2000–2005         | 3                 | 50.50(8.05, 92.48)              | –             |
| 2006–2010         | 8                 | 61.42(45.28, 76.39)             | 98.28         |
| 2011–2015         | 22                | 38.58(27.39, 50.42)             | 98.88         |
| 2016–2020         | 23                | 42.34 (30.75, 54.37)            | 99.29         |
| Risk of bias      |                   |                                 |               |
| Low               | 41                | 43.20(34.53, 52.08)             | 99.19         |
| Moderate          | 11                | 43.26 (26.29, 61.07)            | 98.95         |
| High              | 4                 | 54.30 (42.62,65.75)             | 92.04         |
| Place of residence|                   |                                 |               |
| Urban             | 40                | 48.55(39.20,57.95)              | 99.18         |
| Rural             | 12                | 34.25(23.60, 45.75)             | 98.36         |
| Mixed             | 4                 | 28.78(15.04, 44.86)             | 97.15         |
| Total             | 56                | 44.0% (36.63, 51.50)            | 99.10         |

and university staffs are more aware and skilled about breast self-examination compared to the general population.

The pooled prevalence of regular (monthly) breast self-examination practice was 17.9% (95% CI: 13.36, 22.94) which is comparable (15.2%) with a study done in Vietnam [93]. However, the finding was lower than a study done in Poland (56.7%) [91], Malaysia (41%) [92], Russia (32%) [90]. This might be attributed due to difference in culture and tradition towards breast self-examination in the study population. In addition to this, the level of awareness and information dissemination about breast self-examination frequency and interval is

Table 4 Sensitivity analysis of the included studies to estimate the pooled prevalence of breast self-examination practice among women in Africa

| S. No | Study Omitted | Reason for omission | Pooled prevalence of BSE practice (95% CI) | I² values |
|-------|---------------|---------------------|-------------------------------------------|-----------|
| 1.    | Ogunbode A M, 2015 | High risk of bias | 43.67(36.24–51.2) | 99.10     |
| 2.    | Kayode F.O. et al., 2005 | High risk of bias | 43.84 (36.35–51.46) | 99.11     |
| 3.    | Bayumi E et al., 2016 | High risk of bias | 44.11(36.63–51.73) | 99.12     |
| 4.    | Idris SA et al., 2013 | High risk of bias | 43.63(36.20–51.21) | 99.11     |
| 5.    | Onwere et al., 2009 | Small sample size (100) | 43.37(35.98–50.92) | 99.11     |
| 6.    | Joel Olayiwola Farombi et, 2012 | Small sample size (100) | 43.28(35.90–50.82) | 99.11     |
| 7.    | Makanjuola, OJ et al., 2013 | Small sample size (100) | 44.36(36.90–51.94) | 99.12     |
not well addressed in African women compared to European and Asian. This indicates that even if breast self-examination is the most feasible and affordable option to early diagnose breast cancer, African women are not practicing as per the recommended frequency and interval.

In the sub group analysis, the highest prevalence of ever breast self-examination practice was reported in West African countries 58.87% (95%CI: 48.06, 69.27) compared with other regions. The possible reason for this variation might be attributed due to the difference in the study population. In this review, 25 studies were included from West African region and among this 17(68%) of the studies were conducted among urban residents. In general, urban resident tends to have positive attitudes toward and as well as better awareness about breast self-examination. Breast self-examination practice was higher 63.33% (95% CI: 48.62, 76.88) among health professionals compared with non-health professionals. This might be attributed to the level of awareness about the disease, skill difference to perform the procedure and perception towards breast self-examination practice. Additionally, health care providers are expected to be role models for other women and because of this reason they engaged more in breast self-examination.

Limitation of the study
The estimation of the pooled prevalence of breast self-examination may have been affected by the heterogeneity, as suggested by the very high $I^2$ statistic of 99.10%. This might be attributed to the methodological variation among the included studies. We have also included only articles published in English language and some of the included articles published on emerging journals. Some of the studies included in this review had small sample size and this might affect the pooled estimate finding. Furthermore, most of the studies included in this meta-analysis were represented from west and east African countries due to the limited number of studies in the other areas. Therefore, some regions may be underrepresented.

Conclusion
Implications for practice
This systematic review and meta-analysis found that the pooled prevalence of ever and regular breast self-examination was very low compared with other LMIC and high income countries. Even though, most literatures recommend regular breast self-examination is feasible and practical screening options for LMIC nations, the practice was not satisfactory in Africa. Therefore, intensive behavioral change communication and interventions that emphasize different domains should be given by stakeholders to increase the practice of breast self-examination in Africa.

Implications for research
In low and middle income countries breast self-examination is a feasible and beneficial approach to reduce morbidity and mortality of breast cancer through early diagnosis. Thus, further large scale follow-up studies should be conducted to identify barriers and challenges of breast self-examination practice among women in Africa.
All data pertaining to this review were included and presented in the Availability of data and materials section.

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Availability of data and materials
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Declarations
Ethics approval and consent to participate
Not applicable.

Consent for publication
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Competing interests
We author declare there is no any competing interests on the publication of this paper.

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Abbreviations
BSE: Breast self-examination practice; CBE: Clinical breast examination; CI: Confidence interval; GLOBOCAN: Global Cancer Observatory; JBI-MAStARI: Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument; LMIC: Low and Middle Income Countries; PRISMA: Preferred Reporting Items of Systematic Reviews and Meta-Analysis; SE: Standard error; SDG: Sustainable Development Goal.

Supplementary Information
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Additional file 1.
Additional file 2.

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Authors’ contributions
WS conceived and designed the study, preparation of protocol, analyzed data, and drafted the manuscript. WS and LM select and assess quality of studies, extract data, interpret result, and editing of the manuscript. All authors read and approved final draft of manuscript.

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Competing interests
We author declare there is no any competing interests on the publication of this paper.

Additional file 2.

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