Epidemiological data on systemic lupus erythematosus in native sub-Saharan Africans

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Abstract
Multiethnic studies conducted outside sub-Saharan Africa identify African Black people as the highest-risk group for morbidity and mortality among the 5,000,000 people who are affected by lupus globally. In the meantime, there have bee few attempts to summarize lupus data from sub-Saharan Africa. We therefore conducted a systematic review and meta-analysis addressing systemic lupus erythematosus in Native sub-Saharan Africans. This paper both serves as repository for and describes the data obtained by qualitative and quantitative synthesis, notably the pooled prevalence of autoantibodies, the pooled frequency of cumulative drug use, the prevalence of comorbidities/complications and the mortality rate in Native sub-Saharan Africans with systemic lupus erythematosus. These data are interpreted in the research article titled “Systemic lupus erythematosus in Native sub-Saharan African Black people as the highest-risk group for morbidity and mortality among the 5,000,000 people who are affected by lupus globally.”

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1. Data description

We herein report the pooled prevalence rates of autoantibodies (Fig. 1), the pooled frequencies of cumulative drug use (Fig. 2), the prevalence of comorbidities/complications (Table 1) and the pooled mortality rate (Fig. 3). The main search strategy used (in PUBMED) to obtain these data is displayed in Table 2 and Fig. 4 describes the study selection process. Table 3 summarizes the characteristics of the overall 15 included studies [2–16] whereas Table 4 summarizes only the studies included in the mortality analysis [4,6–9,14,16].

2. Experimental design, materials, and methods

• Searched databases and search strategy
A comprehensive search of PubMed, Excerpta Medica database (EMBASE), Web of Science, African Journals Online, and Global Index Medicus was conducted to identify all relevant articles published from January 1, 2008 to October 7, 2018, without any language restriction. We considered recent studies to have the current and updated clinical overview of systemic lupus erythematosus in the region. We conceived and applied a search strategy based on the combination of relevant terms. The main search strategy in PubMed was adapted for the search in the other databases. A manual search that consists of scanning reference lists of eligible studies and relevant reviews was performed to identify any studies missed during the review process or by the search strategy.

The titles and abstracts of the retrieved papers were independently screened by two investigators (ME and JRN) and the full-texts of papers deemed potentially eligible were further assessed for final inclusion. All discrepancies for study selection were resolved through discussion or with the arbitrage of a third investigator.

- Criteria for considering studies for the review
  - Types of studies
    - Observational studies including cross-sectional, case-control and cohort studies, as well as case series. We did not consider case reports, commentaries, review articles and letters to the editor.
  - Types of participants
    - We considered studies involving African Black people (or multiethnic groups with possibility to extract information for the African Black people) living in sub-Saharan Africa regardless of the age and gender. Studies were excluded if: (1) they included multiethnic groups with no possibility to extract informations regarding only the African Black people (2) they only included a specific group of lupus patients i.e. lupus nephritis, neuropsychiatric lupus, cutaneous lupus, lupus pericarditis, lupus myocarditis, lupus in pregnant women (3) they included patients with overlapping syndromes.
  - Condition
    - The classification for systemic lupus erythematosus was based on the 1982 American College of Rheumatology and/or revised 1997 American College of Rheumatology criteria [17,18].
  - Outcomes of interest
    - The following outcomes were analyzed: systemic lupus erythematosus prevalence; demographic, clinical and immunological characteristics of systemic lupus erythematosus; frequencies of cumulative drug use for the treatment of systemic lupus erythematosus and its complications; outcome measures of systemic lupus erythematosus.

- Data extraction and management

The data were extracted by two investigators (ME and JJB) using a preconceived, piloted and standardized data abstraction form. The following data were extracted and cross-checked to ensure that there was no missing information: name of the first author, year of publication, study design, period of recruitment of the study population, setting (country, unique/multiple site[s]), locality (urban/rural), sampling method, systemic lupus erythematosus diagnostic criteria and the outcomes of interest.
**Fig. 1.** Prevalence of autoantibodies in Native sub-Saharan Africans with systemic lupus erythematosus. Grey boxes represent the effect estimates (prevalence), and the horizontal bars represent the 95% confidence intervals (CI). The size of the boxes is proportional to the inverse variance. The diamonds are for the pooled effect estimates and 95% CI, and the dotted vertical line has been added to assist visual interpretation. ANA antinuclear antibodies; anti-DNA anti-deoxyribonucleic acid; anti-RNP anti-ribonucleoprotein; anti-Sm anti-Smith; anti-SSA anti-Sjogren syndrome antigen A; anti-SSB anti-Sjogren syndrome antigen B; aPL anti-phospholipid antibodies; RF rheumatoid factor.

### Table: Prevalence of Autoantibodies

| Author, Year | Cases | Sample | Prevalence, % [95% C.I.] |
|--------------|-------|--------|---------------------------|
| ANA          |       |        |                           |
| Adelowo, 2009| 64    | 65     | 98.5 [91.7; 100.0]        |
| Adelowo, 2012| 91    | 95     | 98.8 [96.6; 98.8]         |
| Budhoo, 2016 | 135   | 137    | 98.5 [94.8; 99.8]         |
| Diallo, 2009 | 18    | 21     | 85.7 [63.7; 97.0]         |
| Doualla, 2014| 31    | 36     | 86.1 [70.5; 95.3]         |
| Dzifa, 2017  | 41    | 51     | 80.4 [66.9; 90.2]         |
| Ekwom, 2013  | 10    | 13     | 76.9 [46.2; 95.0]         |
| Gbané-Koné, 2015 | 32 | 34 | 94.1 [80.3; 99.3] |
| Iba-Ba, 2009 | 23    | 23     | 100.0 [85.2; 100.0]       |
| Kombate, 2008| 12    | 13     | 92.3 [56.0; 99.3]         |
| Malemba, 2008| 19    | 23     | 82.6 [61.2; 95.0]         |
| Ngaide, 2016 | 9     | 43     | 20.9 [10.0; 36.0]         |
| Zavier, 2014 | 18    | 19     | 94.7 [74.0; 99.9]         |
| **Subgroup prevalence** | 715 | | 89.7 [79.9; 96.5]         |

*Heterogeneity: $I^2 = 92.2\%$ [88.7%; 94.7%], $\tau^2 = 0.0613$, $p < 0.0001$*

### Anti-chromatine

| Author, Year | Cases | Sample | Prevalence, % [95% C.I.] |
|--------------|-------|--------|---------------------------|
| Adelowo, 2012| 10    | 15     | 66.7 [38.4; 88.2]         |
| **Subgroup prevalence** | 15 | | 66.7 [41.7; 87.4]         |

*Heterogeneity: not applicable*

### Anti-DNA

| Author, Year | Cases | Sample | Prevalence, % [95% C.I.] |
|--------------|-------|--------|---------------------------|
| Adelowo, 2009| 14    | 26     | 53.8 [33.4; 73.4]         |
| Adelowo, 2012| 37    | 68     | 54.4 [41.9; 66.5]         |
| Budhoo, 2016 | 73    | 137    | 53.3 [44.6; 61.9]         |
| Diallo, 2014 | 15    | 24     | 62.5 [40.6; 81.2]         |
| Doualla, 2014| 25    | 34     | 73.5 [55.6; 87.1]         |
| Dzifa, 2017  | 27    | 51     | 52.9 [38.5; 67.1]         |
| Ekwom, 2013  | 5     | 13     | 38.5 [13.9; 68.4]         |
| Gbané-Koné, 2015 | 25 | 34 | 73.5 [55.6; 87.1] |
| Iba-Ba, 2009 | 17    | 23     | 73.9 [51.6; 89.8]         |
| Kombate, 2008| 10    | 13     | 76.9 [46.2; 95.0]         |
| Malemba, 2008| 2     | 23     | 8.7 [1.1; 28.0]           |
| Ndiaye, 2010 | 67    | 142    | 47.2 [38.8; 55.7]         |
| Ngaide, 2016 | 11    | 43     | 25.6 [13.5; 41.2]         |
| Zavier, 2014 | 15    | 19     | 78.9 [54.4; 93.9]         |
| **Subgroup prevalence** | 650 | | 54.6 [45.2; 63.9]         |

*Heterogeneity: $I^2 = 81.1\%$ [69.3%; 84.4%], $\tau^2 = 0.0245$, $p < 0.0001$*

### Anti-Jo1

| Author, Year | Cases | Sample | Prevalence, % [95% C.I.] |
|--------------|-------|--------|---------------------------|
| Gbané-Koné, 2015 | 2 | 16 | 12.5 [1.6; 38.3] |
| **Subgroup prevalence** | 16 | | 12.5 [1.3; 32.5] |

*Heterogeneity: not applicable*

### Anti-RNP

| Author, Year | Cases | Sample | Prevalence, % [95% C.I.] |
|--------------|-------|--------|---------------------------|
| Adelowo, 2009| 1     | 12     | 8.3 [0.2; 38.5]           |
| Adelowo, 2012| 27    | 33     | 81.8 [64.5; 93.0]         |
| Budhoo, 2016 | 90    | 137    | 65.7 [57.1; 73.6]         |
| Diallo, 2014 | 22    | 32     | 68.8 [50.0; 83.9]         |
| Gbané-Koné, 2015 | 16 | 16 | 100.0 [79.4; 100.0] |
| Iba-Ba, 2009 | 4     | 23     | 17.4 [5.0; 38.8]          |
| Ndiaye, 2010 | 111   | 142    | 78.2 [70.5; 84.7]         |
| Ngaide, 2016 | 8     | 43     | 18.6 [8.4; 33.4]          |
| **Subgroup prevalence** | 438 | | 57.9 [36.4; 77.9]         |

*Heterogeneity: $I^2 = 94.5\%$ [91.4%; 96.6%], $\tau^2 = 0.0897$, $p < 0.0001$*
**Test for subgroup differences:**

\[ \chi^2 = 90.40, \text{df} = 11 \quad (p < 0.0001) \]

### Anti–Scl 70

| Subgroup prevalence | 16 | 12.5 [1.3; 32.5] |
|---------------------|----|----------------|

Heterogeneity: not applicable

### Anti–Sm

| Subgroup prevalence | 473 | 53.5 [40.4; 66.2] |
|---------------------|-----|-----------------|

Heterogeneity: \( I^2 = 85.6\% [75.3\% ; 91.6\%] \), \( \tau^2 = 0.0352, \quad p < 0.0001 \)

### Anti–SSA

| Subgroup prevalence | 324 | 45.6 [19.2; 73.4] |
|---------------------|-----|-----------------|

Heterogeneity: \( I^2 = 95.8\% [90.5\% ; 97.2\%] \), \( \tau^2 = 0.1620, \quad p < 0.0001 \)

### Anti–SSB

| Subgroup prevalence | 82 | 33.7 [13.6; 57.6] |
|---------------------|----|-----------------|

Heterogeneity: \( I^2 = 78.9\% [32.4\% ; 93.4\%] \), \( \tau^2 = 0.0357, \quad p = 0.0088 \)

### Anticardiolipin

| Subgroup prevalence | 69 | 26.0 [3.8; 58.8] |
|---------------------|----|-----------------|

Heterogeneity: \( I^2 = 85.5\% [57.3\% ; 95.7\%] \), \( \tau^2 = 0.0744, \quad p = 0.0010 \)

### Any aPL

| Subgroup prevalence | 85 | 28.5 [9.4; 52.8] |
|---------------------|----|-----------------|

Heterogeneity: \( I^2 = 79.7\% [46.9\% ; 92.3\%] \), \( \tau^2 = 0.0506, \quad p = 0.0020 \)

### RF

| Subgroup prevalence | 38 | 21.0 [9.7; 35.1] |
|---------------------|----|-----------------|

Heterogeneity: \( I^2 = 0\% \), \( \tau^2 = 0, \quad p = 0.6404 \)

Test for subgroup differences: \( \chi^2 = 90.40, \text{df} = 11 \quad (p < 0.0001) \)

**Fig. 1.** (continued).
### Antimalarials

| Author, Year | Cases | Sample | Frequency, % [95% C.I.] |
|--------------|-------|--------|------------------------|
| Adelowo, 2009 | 10    | 66     | 15.2 [7.5; 26.1]        |
| Doualla, 2014 | 27    | 39     | 69.2 [52.4; 83.0]       |
| Ekwom, 2013   | 12    | 13     | 92.3 [64.0; 99.8]       |
| Iba–Ba, 2009  | 14    | 23     | 60.9 [38.5; 80.3]       |
| Kombate, 2008 | 4     | 16     | 25.0 [7.3; 52.4]        |
| Ndiaye, 2010  | 142   | 142    | 100.0 [97.4; 100.0]     |
| Zavier, 2014  | 15    | 33     | 45.5 [28.1; 63.6]       |
| **Subgroup frequency** | **332** |         | **62.8 [23.3; 94.1]**   |

Heterogeneity: $I^2 = 98\%$ [97.1%; 98.6%], $\tau^2 = 0.2980$, $p < 0.0001$

### Azathioprine

| Author, Year | Cases | Sample | Frequency, % [95% C.I.] |
|--------------|-------|--------|------------------------|
| Doualla, 2014 | 12    | 39     | 30.8 [17.0; 47.6]       |
| Ekwom, 2013   | 5     | 13     | 38.5 [13.9; 68.4]       |
| Iba–Ba, 2009  | 1     | 23     | 4.3 [0.1; 21.9]         |
| Kombate, 2008 | 2     | 16     | 12.5 [1.6; 38.3]        |
| **Subgroup frequency** | **91** |         | **19.3 [6.0; 37.7]**    |

Heterogeneity: $I^2 = 73.2\%$ [24.6%; 90.5%], $\tau^2 = 0.0321$, $p = 0.0107$

### Corticosteroids

| Author, Year | Cases | Sample | Frequency, % [95% C.I.] |
|--------------|-------|--------|------------------------|
| Adelowo, 2009 | 66    | 66     | 100.0 [94.6; 100.0]     |
| Dzifa, 2017   | 45    | 51     | 88.2 [76.1; 95.6]       |
| Ekwom, 2013   | 13    | 13     | 100.0 [75.3; 100.0]     |
| Iba–Ba, 2009  | 23    | 23     | 100.0 [85.2; 100.0]     |
| Kombate, 2008 | 16    | 16     | 100.0 [79.4; 100.0]     |
| Ndiaye, 2010  | 142   | 142    | 100.0 [97.4; 100.0]     |
| Zavier, 2014  | 30    | 33     | 90.9 [75.7; 93.1]       |
| **Subgroup frequency** | **344** |         | **99.0 [94.9; 100.0]**  |

Heterogeneity: $I^2 = 78.8\%$ [56.3%; 89.7%], $\tau^2 = 0.0215$, $p < 0.0001$

### Cyclophosphamide

| Author, Year | Cases | Sample | Frequency, % [95% C.I.] |
|--------------|-------|--------|------------------------|
| Doualla, 2014 | 12    | 39     | 30.8 [17.0; 47.6]       |
| Ekwom, 2013   | 6     | 13     | 46.2 [19.2; 74.9]       |
| Iba–Ba, 2009  | 1     | 23     | 4.3 [0.1; 21.9]         |
| Kombate, 2008 | 1     | 16     | 6.2 [0.2; 30.2]         |
| **Subgroup frequency** | **91** |         | **18.7 [4.1; 40.4]**    |

Heterogeneity: $I^2 = 80.4\%$ [48.5%; 92.6%], $\tau^2 = 0.0483$, $p = 0.0016$

### Low dose Aspirin

| Author, Year | Cases | Sample | Frequency, % [95% C.I.] |
|--------------|-------|--------|------------------------|
| Adelowo, 2009 | 11    | 66     | 16.7 [8.6; 27.9]        |
| **Subgroup frequency** | **66** |         | **16.7 [8.7; 26.5]**    |

Heterogeneity: not applicable

### Methotrexate

| Author, Year | Cases | Sample | Frequency, % [95% C.I.] |
|--------------|-------|--------|------------------------|
| Doualla, 2014 | 4     | 39     | 10.3 [2.9; 24.2]        |
| Ekwom, 2013   | 2     | 13     | 15.4 [1.9; 45.4]        |
| Zavier, 2014  | 4     | 33     | 12.1 [3.4; 28.2]        |
| **Subgroup frequency** | **85** |         | **11.7 [5.8; 19.4]**    |

Heterogeneity: $I^2 = 0\%$ [0%; 13.4%], $\tau^2 = 0$, $p = 0.8868$

### NSAIDS

| Author, Year | Cases | Sample | Frequency, % [95% C.I.] |
|--------------|-------|--------|------------------------|
| Adelowo, 2009 | 20    | 66     | 30.3 [19.6; 42.9]       |
| Ekwom, 2013   | 10    | 13     | 76.9 [46.2; 95.0]       |
| **Subgroup frequency** | **79** |         | **52.5 [10.8; 92.1]**   |

Heterogeneity: $I^2 = 90.3\%$, $\tau^2 = 0.1070$, $p = 0.0013$

Test for subgroup differences: $\chi^2 = 212.39$, df = 6 ($p < 0.0001$)
Assessment of the methodological quality of studies

We used an adapted version of the tool developed by Hoy and colleagues [19] to assess the methodological quality of included studies. Three investigators (JJB, ME and FTAE) independently ran the assessment. Discrepancies were discussed and resolved by these investigators. Cohen’s $\kappa$ statistics were used for inter-rater agreements between investigators regarding study inclusion and for the assessment of the methodological quality of the included studies.

Data synthesis and analysis

The quantitative synthesis was done using the ‘meta’ packages of the R statistical software (version 3.5.1, The R Foundation for statistical computing, Vienna, Austria). We used the reference method for prevalence synthesis suggested by Barendregt and colleagues [20]. The prevalence of systemic lupus erythematosus and systemic lupus erythematosus autoantibodies, the frequencies of cumulative drug use and the mortality rate were recalculated based on crude numerators and denominators provided.

### Table 1

| Complications/comorbidities                                      | Prevalence, range % |
|------------------------------------------------------------------|---------------------|
| Infections [5,6,8,9,11,12]                                        | 4.3–68.7            |
| Cardiovascular diseases and risk factors                         |                     |
| - Heart failure [8]                                              | 33.3                |
| - Stroke [6,10,12]                                               | 5.1–6.8             |
| - Peripheral vein thrombosis [8,11]                              | 2–4.3               |
| - Diabetes mellitus [6,12]                                       | 5.1–18.7            |
| - Hypertension [2,6,9]                                           | 10.3–19.6           |
| Chronic kidney disease [6,10,12,16]                              | 6.2–9.4             |
| Any aseptic osteonecrosis [6,10]                                 | 2.6–6.2             |

### Mortality rate

| Author, Year | Cases | Sample | Mortality rate, % [95% C.I.] |
|--------------|-------|--------|------------------------------|
| Budhoo, 2016 | 16    | 137    | 11.7 [6.8; 18.3]             |
| Doualla, 2014| 2     | 39     | 5.1 [0.6; 17.3]              |
| Dubula, 2014 | 8     | 56     | 14.3 [6.4; 26.2]             |
| Dzifa, 2017  | 22    | 51     | 43.1 [29.3; 57.8]            |
| Ekwom, 2013  | 0     | 13     | 0.0 [0.0; 24.7]              |
| Ndiaye, 2010 | 4     | 142    | 2.8 [0.8; 7.1]               |
| Zavier, 2014 | 4     | 33     | 12.1 [3.4; 28.2]             |

### Prevalence

| Prevalence | Sample |
|------------|--------|
| 471        |        |

### Prediction interval

Heterogeneity: $\chi^2 = 88.8\%$ [79.3%; 93.9%]. $\tau^2 = 0.0320, p < 0.0001$}

Fig. 3. Mortality rate in Native sub-Saharan Africans with systemic lupus erythematosus. Grey boxes represent the effect estimates (prevalence), and the horizontal bars represent the 95% confidence intervals (CI). The size of the boxes is proportional to the inverse variance. The diamonds are for the pooled effect estimates and 95% CI, and the dotted vertical line has been added to assist visual interpretation.

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Fig. 2. Frequency of cumulative drug use among Native sub-Saharan Africans with systemic lupus erythematosus. Grey boxes represent the effect estimates (frequency), and the horizontal bars represent the 95% confidence intervals (CI). The size of the boxes is proportional to the inverse variance. The diamonds are for the pooled effect estimates and 95% CI, and the dotted vertical line has been added to assist visual interpretation.
| Search | Search terms |
|--------|--------------|
| #1     | “systemic lupus erythematosus” OR “disseminated lupus erythematosus” OR SLE OR DLE OR “lupus nephritis” OR “renal SLE” OR “cutaneous lupus” OR “cutaneous DLE” OR “Lupus Erythematosus Disseminatus” OR “Libman-Sacks Disease” OR “Lupus vasculitis” |
| #2     | Africa OR Algeria OR Angola OR Benin OR Botswana OR “Burkina Faso” OR Burundi OR Cameroon OR “Canary Islands” OR “Cape Verde” OR “Central African Republic” OR Chad OR Comoros OR Congo OR “Democratic Republic of Congo” OR Djibouti OR Egypt OR “Equatorial Guinea” OR Eritrea OR Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR “Guinea Bissau” OR “Ivy Coast” OR “Cote Ivoire” OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Reunion OR Rwanda OR “Sao Tome” OR Senegal OR Seychelles OR “Sierra Leone” OR Somalia OR “South Africa” OR “St Helena” OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR “Western Sahara” OR Zaire OR Zambia OR Zimbabwe OR “Central Africa” OR “Central African” OR “West Africa” OR “Western Africa” OR “Western African” OR “East Africa” OR “East African” OR “Eastern Africa” OR “Eastern African” OR “North Africa” OR “North African” OR “Northern Africa” OR “Northern African” OR “South African” OR “Southern Africa” OR “Southern African” OR “sub Saharaan Africa” OR “sub Saharan African” OR “subSaharan African” OR “subSaharan African” |
| #3     | #1 AND #2 |

Fig. 4. PRISMA flow chart of study selection. SLE systemic lupus erythematosus.
| Study          | Design  | Country         | Setting            | Locality | Period of recruitment | Number of participants | Number of participants with SLE | Number of participants with SLE | Classification criteria for SLE | Females, n (%) | Mean age at diagnosis of SLE, y | Age range, y | Study quality |
|---------------|---------|-----------------|--------------------|----------|-----------------------|------------------------|-------------------------------|-------------------------------|-------------------------------|----------------|-------------------------------|---------------|---------------|
| Adelowo. 2009 [9] | Cross-sectional | Nigeria | Hospital based | Urban     | 2001–2006             | 1250                   | 66                            | 1982 ACR                       | 63 (95.5)                   | 33         | 16–60                        | Moderate     |
| Adelowo. 2012 [10] | Cross-sectional | Nigeria | Hospital based | Urban     | 2001–2010             | 95                     | 95                            | 1982 ACR                       | 91 (95.7)                   | 33.4       | 17–55                       | Low          |
| Budhoo. 2016 [11] | Cross-sectional | South Africa | Hospital based | Urban     | 2003–2012             | 137                    | 137                           | 1997 ACR                       | 125 (91.2)                  | 32.2       | NR                          | Low          |
| Diallo. 2014 [12] | Cross-sectional | Senegal | Hospital based | Urban     | 2010–2012             | 35                     | 35                            | 1997 ACR                       | 33 (94.3)                   | 32.8       | 18–50                       | Low          |
| Doualla. 2014 [13] | Cross-sectional | Cameroon | Hospital based | Urban     | 1999–2009             | 6485                   | 39                            | 1997 ACR                       | 36 (92.3)                   | 39.2       | 19–59                       | Moderate     |
| Dubulla. 2014 [14] | Cross-sectional | South Africa | Hospital based | Urban     | 2003–2009             | 56                     | 56                            | 1982 ACR and 1997 ACR          | 51 (91.2)                   | 30.3       | NR                          | Low          |
| Dzifa. 2017 [15]  | Cohort  | Ghana           | Hospital based | Urban     | 2007–2009             | 51                     | 51                            | 1982 ACR                       | 45 (86.5)                   | 30.4       | 14–68                       | Moderate     |
| Ekwom. 2013 [16]  | Cross-sectional | Kenya     | Hospital based | Urban     | 2010–2011             | 394                    | 13                            | 1982 ACR and 1997 ACR          | 13 (100)                    | 34         | 12–52                       | High         |
| Gbané-Koné. 2015 [17] | Cross-sectional | Ivory Coast | Hospital based | Urban     | 1987–2014             | 18,076                 | 117                           | 1982 ACR                       | 115 (98.3)                  | 35.8       | 12–73                       | Moderate     |
| Iba-Ba. 2009 [18] | Cross-sectional | Gabon     | Hospital based | Urban     | 2004–2008             | 23                     | 23                            | 1982 ACR and 1997 ACR          | 22 (95.6)                   | 32.8       | 18–68                       | Moderate     |
| Kombate. 2008 [19] | Cross-sectional | Togo      | Hospital based | Urban     | 1991–2003             | 16                     | 16                            | 1997 ACR                       | 16 (100)                    | 31.9       | 15–46                       | Low          |
| Malemba. 2008 [20] | Cross-sectional | Congo, RD | Hospital based | Urban     | 1988–2002             | 2370                   | 23                            | 1982 ACR                       | 21 (91.3)                   | 31.8       | NR                          | Low          |
| Ndiaye. 2008 [21]  | Cross-sectional | Senegal   | Hospital based | Urban     | 1997–2006             | 142                    | 142                           | 1982 ACR and 1997 ACR          | 125 (88)                    | 34         | 6–72                        | Low          |
| Ngaidé. 2016 [22] | Cross-sectional | Senegal   | Hospital based | Urban     | 2011–2012             | 50                     | 50                            | 1997 ACR                       | 46 (92)                     | 36.2       | 14–60                       | Moderate     |
| Zavier. 2014 [23] | Cross-sectional | Benin     | Hospital based | Urban     | 2000–2013             | 33                     | 33                            | 1997 ACR                       | 32 (97)                     | 28.8       | 16–51                       | Low          |

SLE systemic lupus erythematosus; ACR American College of Rheumatology; n number; y years; NR not reported; Congo RD Democratic Republic of the Congo.
by individual studies. To minimize the effect of studies with extremely small or extremely large prevalence estimates on the overall estimate, the variance of study-specific prevalence was stabilized with the Freeman-Tukey double arcsine transformation before pooling the data with the random effects meta-analysis model [20]. Heterogeneity was assessed by the chi-square test on Cochrane's Q statistic, and quantified by I² values. Low, moderate and high heterogeneity were considered for I² values of 25%, 50% and 75% respectively. The quality of the included studies is described in Table 3. The Egger's test was used to assess the presence of publication bias, and a statistically significant publication bias was considered for p-values < 0.1. We decided a priori that if we find publication bias, we will do no adjustment in regard, since we believed that the prevalence estimates of interest would likely be published even if they are substantially different from the previously reported estimates.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Table 4
Summary of studies reporting a mortality rate in Native sub-Saharan Africans with systemic lupus erythematosus.

| Study | Design | Country | Duration of SLE | Duration of follow up | Mortality rate | Study quality |
|-------|--------|---------|-----------------|-----------------------|----------------|---------------|
| Dzifa. 2017 [8] | Cohort | Ghana | Mean 25.2 ± 31.5 months (1–143) | Mean 26.1 ± 26.6 days (1–140) | 43.1 | Moderate |
| Dubula. 2014 [7] | Cross-sectional | South Africa | Median 8 months (IQR, 1–61) | 3–106 days | 14.3 | Low |
| Budhoo. 2016 [4] | Cross-sectional | South Africa | Median 42 months (IQR, 22–88.3) | Median 36 months (IQR, 12.5–68) | 11.7 | Low |
| Zavier. 2014 [16] | Cross-sectional | Benin | NR | NR | 12.1 | Low |
| Doualla. 2014 [6] | Cross-sectional | Cameroon | NR | NR | 5.1 | Moderate |
| Ndiaye. 2010 [14] | Cross-sectional | Senegal | NR | 10 days–117 months | 2.8 | Low |
| Ekwom. 2013 [9] | Cross-sectional | Kenya | 1–12 months | 1–12 months | 0.0 | High |

SLE systemic lupus erythematosus; IQR interquartile range; NR not reported.
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