Genomic Epidemiology of SARS-CoV-2 in Africa: Regional and Country-specific builds

**Regional builds**

|  |  |
| --- | --- |
| Region | Regional Builds |
| Central African Region | [https://nextstrain.org/groups/africa-cdc/ncov/central-africa](https://nextstrain.org/groups/africa-cdc/ncov/central-africa?c=clade_membership&f_country=Burundi,Cameroon,Central%20African%20Republic,Democratic%20Republic%20of%20the%20Congo,Equatorial%20Guinea,Gabon,Republic%20of%20the%20Congo,Chad&p=grid&tl=country) |
| Eastern African Region | [https://nextstrain.org/groups/africa-cdc/ncov/eastern-africa](https://nextstrain.org/groups/africa-cdc/ncov/eastern-africa?c=clade_membership&f_country=Comoros,Djibouti,Ethiopia,Kenya,Madagascar,Mauritius,Rwanda,Seychelles,Somalia,South%20Sudan,Sudan,Uganda&p=grid&tl=country) |
| Northern African Region | [https://nextstrain.org/groups/africa-cdc/ncov/northern-africa](https://nextstrain.org/groups/africa-cdc/ncov/northern-africa?c=clade_membership&f_country=Algeria,Egypt,Libya,Morocco,Tunisia&p=grid&tl=country) |
| Southern African Region | [https://nextstrain.org/groups/africa-cdc/ncov/southern-africa](https://nextstrain.org/groups/africa-cdc/ncov/southern-africa?c=clade_membership&f_country=Angola,Botswana,Eswatini,Lesotho,Malawi,Mozambique,Namibia,South%20Africa,Zambia,Zimbabwe&p=grid&tl=country) |
| Western African Region | [https://nextstrain.org/groups/africa-cdc/ncov/western-africa](https://nextstrain.org/groups/africa-cdc/ncov/western-africa?c=clade_membership&f_country=Benin,Burkina%20Faso,Cabo%20Verde,Cote%20d%27Ivoire,Gambia,Ghana,Guinea,Liberia,Mali,Niger,Nigeria,Senegal,Sierra%20Leone,Togo&p=grid&tl=country) |

**Country-specific builds**

|  |  |  |
| --- | --- | --- |
| Region | Country | Build |
| Central African Region | Burundi | [https://nextstrain.org/groups/africa-cdc/ncov/burundi](https://nextstrain.org/groups/africa-cdc/ncov/burundi?c=clade_membership&f_country=Burundi&p=grid&tl=country) |
| Cameroon | [https://nextstrain.org/groups/africa-cdc/ncov/cameroon](https://nextstrain.org/groups/africa-cdc/ncov/cameroon?c=clade_membership&f_country=Cameroon&p=grid&tl=country) |
| Central African Republic | [https://nextstrain.org/groups/africa-cdc/ncov/central-african-republic](https://nextstrain.org/groups/africa-cdc/ncov/central-african-republic?c=clade_membership&f_country=Central%20African%20Republic&p=grid&tl=country) |
| Chad | [https://nextstrain.org/groups/africa-cdc/ncov/chad](https://nextstrain.org/groups/africa-cdc/ncov/chad?c=clade_membership&f_country=Chad&p=grid&tl=country) |
| Republic of Congo | [https://nextstrain.org/groups/africa-cdc/ncov/republic-of-the-congo](https://nextstrain.org/groups/africa-cdc/ncov/republic-of-the-congo?c=clade_membership&f_country=Republic%20of%20the%20Congo&p=grid&tl=country) |
| Democratic Republic of Congo | [https://nextstrain.org/groups/africa-cdc/ncov/democratic-republic-of-the-congo](https://nextstrain.org/groups/africa-cdc/ncov/democratic-republic-of-the-congo?c=clade_membership&f_country=Democratic%20Republic%20of%20the%20Congo&p=grid&tl=country) |
| Equatorial Guinea | [https://nextstrain.org/groups/africa-cdc/ncov/equatorial-guinea](https://nextstrain.org/groups/africa-cdc/ncov/equatorial-guinea?c=clade_membership&f_country=Equatorial%20Guinea&p=grid&tl=country) |
| Gabon | [https://nextstrain.org/groups/africa-cdc/ncov/gabon](https://nextstrain.org/groups/africa-cdc/ncov/gabon?c=clade_membership&f_country=Gabon&p=grid&tl=country) |
| Eastern African Region | Comoros | [https://nextstrain.org/groups/africa-cdc/ncov/comoros](https://nextstrain.org/groups/africa-cdc/ncov/comoros?c=clade_membership&f_country=Comoros&p=grid&tl=country) |
| Djibouti | [https://nextstrain.org/groups/africa-cdc/ncov/djibouti](https://nextstrain.org/groups/africa-cdc/ncov/djibouti?c=clade_membership&f_country=Djibouti&p=grid&tl=country) |
| Ethiopia | [https://nextstrain.org/groups/africa-cdc/ncov/ethiopia](https://nextstrain.org/groups/africa-cdc/ncov/ethiopia?c=clade_membership&f_country=Ethiopia&p=grid&tl=country) |
| Kenya | [https://nextstrain.org/groups/africa-cdc/ncov/kenya](https://nextstrain.org/groups/africa-cdc/ncov/kenya?c=clade_membership&f_country=Kenya&p=grid&tl=country) |
| Madagascar | [https://nextstrain.org/groups/africa-cdc/ncov/madagascar](https://nextstrain.org/groups/africa-cdc/ncov/madagascar?c=clade_membership&f_country=Madagascar&p=grid&tl=country) |
| Mauritius | [https://nextstrain.org/groups/africa-cdc/ncov/mauritius](https://nextstrain.org/groups/africa-cdc/ncov/mauritius?c=clade_membership&f_country=Mauritius&p=grid&tl=country) |
| Rwanda | [https://nextstrain.org/groups/africa-cdc/ncov/rwanda](https://nextstrain.org/groups/africa-cdc/ncov/rwanda?c=clade_membership&f_country=Rwanda&p=grid&tl=country) |
| Seychelles | [https://nextstrain.org/groups/africa-cdc/ncov/seychelles](https://nextstrain.org/groups/africa-cdc/ncov/seychelles?c=clade_membership&f_country=Seychelles&p=grid&tl=country) |
| Somalia | [https://nextstrain.org/groups/africa-cdc/ncov/somalia](https://nextstrain.org/groups/africa-cdc/ncov/somalia?c=clade_membership&f_country=Somalia&p=grid&tl=country) |
| South Sudan | [https://nextstrain.org/groups/africa-cdc/ncov/south-sudan](https://nextstrain.org/groups/africa-cdc/ncov/south-sudan?c=clade_membership&f_country=South%20Sudan&p=grid&tl=country) |
| Sudan | [https://nextstrain.org/groups/africa-cdc/ncov/sudan](https://nextstrain.org/groups/africa-cdc/ncov/sudan?c=clade_membership&f_country=Sudan&p=grid&tl=country) |
| Uganda | [https://nextstrain.org/groups/africa-cdc/ncov/uganda](https://nextstrain.org/groups/africa-cdc/ncov/uganda?c=clade_membership&f_country=Uganda&p=grid&tl=country) |
| Northern African Region | Algeria | [https://nextstrain.org/groups/africa-cdc/ncov/algeria](https://nextstrain.org/groups/africa-cdc/ncov/algeria?c=clade_membership&f_country=Algeria&p=grid&tl=country) |
| Egypt | [https://nextstrain.org/groups/africa-cdc/ncov/egypt](https://nextstrain.org/groups/africa-cdc/ncov/egypt?c=clade_membership&f_country=Egypt&p=grid&tl=country) |
| Libya | [https://nextstrain.org/groups/africa-cdc/ncov/libya](https://nextstrain.org/groups/africa-cdc/ncov/libya?c=clade_membership&f_country=Libya&p=grid&tl=country) |
| Morocco | [https://nextstrain.org/groups/africa-cdc/ncov/morocco](https://nextstrain.org/groups/africa-cdc/ncov/morocco?c=clade_membership&f_country=Morocco&p=grid&tl=country) |
| Tunisia | [https://nextstrain.org/groups/africa-cdc/ncov/tunisia](https://nextstrain.org/groups/africa-cdc/ncov/tunisia?c=clade_membership&f_country=Tunisia&p=grid&tl=country) |
| Southern African Region | Angola | [https://nextstrain.org/groups/africa-cdc/ncov/angola](https://nextstrain.org/groups/africa-cdc/ncov/angola?c=clade_membership&f_country=Angola&p=grid&tl=country) |
| Botswana | [https://nextstrain.org/groups/africa-cdc/ncov/botswana](https://nextstrain.org/groups/africa-cdc/ncov/botswana?c=clade_membership&f_country=Botswana&p=grid&tl=country) |
| Eswatini | [https://nextstrain.org/groups/africa-cdc/ncov/eswatini](https://nextstrain.org/groups/africa-cdc/ncov/eswatini?c=clade_membership&f_country=Eswatini&p=grid&tl=country) |
| Lesotho | [https://nextstrain.org/groups/africa-cdc/ncov/lesotho](https://nextstrain.org/groups/africa-cdc/ncov/lesotho?c=clade_membership&f_country=Lesotho&p=grid&tl=country) |
| Malawi | [https://nextstrain.org/groups/africa-cdc/ncov/malawi](https://nextstrain.org/groups/africa-cdc/ncov/malawi?c=clade_membership&f_country=Malawi&p=grid&tl=country) |
| Mozambique | [https://nextstrain.org/groups/africa-cdc/ncov/mozambique](https://nextstrain.org/groups/africa-cdc/ncov/mozambique?c=clade_membership&f_country=Mozambique&p=grid&tl=country) |
| Namibia | [https://nextstrain.org/groups/africa-cdc/ncov/namibia](https://nextstrain.org/groups/africa-cdc/ncov/namibia?c=clade_membership&f_country=Namibia&p=grid&tl=country) |
| South Africa | [https://nextstrain.org/groups/africa-cdc/ncov/south-africa](https://nextstrain.org/groups/africa-cdc/ncov/south-africa?c=clade_membership&f_country=South%20Africa&p=grid&tl=country) |
| Zambia | [https://nextstrain.org/groups/africa-cdc/ncov/zambia](https://nextstrain.org/groups/africa-cdc/ncov/zambia?c=clade_membership&f_country=Zambia&p=grid&tl=country) |
| Zimbabwe | [https://nextstrain.org/groups/africa-cdc/ncov/zimbabwe](https://nextstrain.org/groups/africa-cdc/ncov/zimbabwe?c=clade_membership&f_country=Zimbabwe&p=grid&tl=country) |
| Western African Region | Benin | [https://nextstrain.org/groups/africa-cdc/ncov/benin](https://nextstrain.org/groups/africa-cdc/ncov/benin?c=clade_membership&f_country=Benin&p=grid&tl=country) |
| Burkina Faso | [https://nextstrain.org/groups/africa-cdc/ncov/burkina-faso](https://nextstrain.org/groups/africa-cdc/ncov/burkina-faso?c=clade_membership&f_country=Burkina%20Faso&p=grid&tl=country) |
| Cabo Verde | [https://nextstrain.org/groups/africa-cdc/ncov/cabo-verde](https://nextstrain.org/groups/africa-cdc/ncov/cabo-verde?c=clade_membership&f_country=Cabo%20Verde&p=grid&tl=country) |
| Cote d’Ivoire | [https://nextstrain.org/groups/africa-cdc/ncov/cote-divoire](https://nextstrain.org/groups/africa-cdc/ncov/cote-divoire?c=clade_membership&f_country=Cote%20d%27Ivoire&p=grid&tl=country) |
| Gambia | [https://nextstrain.org/groups/africa-cdc/ncov/gambia](https://nextstrain.org/groups/africa-cdc/ncov/gambia?c=clade_membership&f_country=Gambia&p=grid&tl=country) |
| Ghana | [https://nextstrain.org/groups/africa-cdc/ncov/ghana](https://nextstrain.org/groups/africa-cdc/ncov/ghana?c=clade_membership&f_country=Ghana&p=grid&tl=country) |
| Guinea | [https://nextstrain.org/groups/africa-cdc/ncov/guinea](https://nextstrain.org/groups/africa-cdc/ncov/guinea?c=clade_membership&f_country=Guinea&p=grid&tl=country) |
| Guinea-Bissau | [https://nextstrain.org/groups/africa-cdc/ncov/guinea-bissau](https://nextstrain.org/groups/africa-cdc/ncov/guinea-bissau?c=clade_membership&f_country=Guinea-Bissau&p=grid&tl=country) |
| Liberia | [https://nextstrain.org/groups/africa-cdc/ncov/liberia](https://nextstrain.org/groups/africa-cdc/ncov/liberia?c=clade_membership&f_country=Liberia&p=grid&tl=country) |
| Mali | [https://nextstrain.org/groups/africa-cdc/ncov/mali](https://nextstrain.org/groups/africa-cdc/ncov/mali?c=clade_membership&f_country=Mali&p=grid&tl=country) |
| Niger | [https://nextstrain.org/groups/africa-cdc/ncov/niger](https://nextstrain.org/groups/africa-cdc/ncov/niger?c=clade_membership&f_country=Niger&p=grid&tl=country) |
| Nigeria | [https://nextstrain.org/groups/africa-cdc/ncov/nigeria](https://nextstrain.org/groups/africa-cdc/ncov/nigeria?c=clade_membership&f_country=Nigeria&p=grid&tl=country) |
| Senegal | [https://nextstrain.org/groups/africa-cdc/ncov/senegal](https://nextstrain.org/groups/africa-cdc/ncov/senegal?c=clade_membership&f_country=Senegal&p=grid&tl=country) |
| Sierra Leone | [https://nextstrain.org/groups/africa-cdc/ncov/sierra-leone](https://nextstrain.org/groups/africa-cdc/ncov/sierra-leone?c=clade_membership&f_country=sierra%20leone&p=grid&tl=country) |
| Togo | [https://nextstrain.org/groups/africa-cdc/ncov/togo](https://nextstrain.org/groups/africa-cdc/ncov/togo?c=clade_membership&f_country=Togo&p=grid&tl=country) |

Methods:

Regional and country-specific Nextstrain builds

The Nextstrain pipeline (<https://github.com/nextstrain/ncov>) was used to generate the regional and country-specific builds (53). Sequencing data from the rest of the world were included for phylogenetic context based on genomic proximity and even sampling over time. For computational feasibility, ease of interpretation, and to balance heterogeneous sampling efforts between countries, genomes were subsampled across time and geography resulting in final builds of ~6000 genomes for each build.

To prepare data for Africa-specific Nextstrain analyses, we downloaded the complete GISAID sequence and metadata files from <https://www.gisaid.org/>. We selected all records for which “Africa” was in the metadata’s “Location” field. For the phylogenetic context, we downloaded the sequences and metadata for the most recent Nextstrain Africa analysis (<https://nextstrain.org/ncov/gisaid/africa/6m>) which are provided as downloads by GISAID as “nextregions” for Africa. These region-specific data are curated by the Nextstrain team to select approximately 4000 total genomes with a 4:1 ratio of focal (e.g., African genomes) to contextual (e.g., non-African genomes) samples and a 4:1 ratio of recent (collected in the last 6 months) to early (collected more than 6 months ago) genomes. The specific subsampling scheme is available on GitHub at <https://github.com/nextstrain/ncov/blob/54d84c560a5a4a7d1434619577920de532a048ee/nextstrain_profiles/nextstrain-gisaid/builds.yaml#L251-L280>.

For each country-specific Nextstrain analysis, we sampled up to 5000 genomes for the given country. For most countries, this limit exceeded the total number of available genomes. To provide phylogenetic context for these country-specific genomes, we also selected 1000 random sequences from the Africa “nextregions” records that were not collected in the given country.

For each African-region-specific Nextstrain analysis, we sampled up to 5000 genomes from all countries in the given region, sampling evenly by country and collection year and month. To provide phylogenetic context, we selected 1000 random sequences from the Africa “nextregions” records that were not collected in the countries for the given region.

We run the phylogenies for each African country and region on a weekly basis using the Nextstrain ncov workflow available at <https://github.com/nextstrain/ncov> and published the phylogenies to the Africa CDC’s Nextstrain Group at <https://nextstrain.org/groups/africa-cdc>.

**Reference:**

53. Hadfield, J. *et al.* Nextstrain: real-time tracking of pathogen evolution. *Bioinformatics* **34**, 4121–4123 (2018).