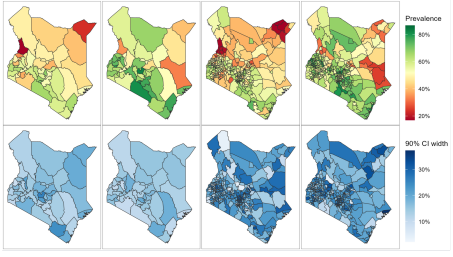
sae4lmic: The Results Website and the Indicator Comparison App

Pre-computed subnational estimates for 13 countries:
what they show, how to use them, how they are built

The sae4health team

sae4lmic overview

Small Area Estimation for Improving Health in LMICs



What this session covers

1. Why a results-only website
2. sae4lmic at a glance: countries, surveys, indicators
3. A tour: home, country overview, indicator pages
4. Reading the maps, intervals and ridge plots
5. Methods and downloads
6. The indicator comparison app
7. Reading comparison plots carefully
8. How the site and the app are built
9. Where each tool fits, limitations, and what's next

Website: https://sae4lmic.stat.uw.edu/
Comparison app: https://rsc.stat.washington.edu/app_direct/indicatorcomparison/
All figures in this deck are taken from the live site and app (Kenya and Nigeria examples).

Why a results-only website?

From modelling tools to ready-made estimates

- The DHS and MICS apps are **tools**: the user picks an indicator, checks sparsity, fits models and interprets them.
- Many users want **numbers**, not a modelling workflow: programme managers, ministries, partners, journalists.
- sae4lmic publishes estimates that the team has **already modelled and checked**, for a fixed set of countries and indicators.
- Every page links back to the tools: the DHS app for other indicators, and the sae4health site for methods.

Think of sae4lmic as the **reference shelf**, and the apps as the **workshop**.

Developed by researchers at the University of Washington and UC Santa Cruz, with support from the Gates Foundation.

sae4lmic at a glance

13
countries in sub-Saharan Africa

20
indicators in four groups

2
DHS rounds per country: baseline and latest

2
admin levels, with maps of mean and uncertainty

- **Main tabs:** Burkina Faso, DRC, Ethiopia, Kenya, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Zambia.
- **More Countries:** Mali, Sierra Leone, Malawi.

- Admin-1 and Admin-2 use each country's own names: counties and sub-counties (Kenya), states and LGAs (Nigeria), regions and zones (Ethiopia).
- Every country has a PDF report and a CSV of all estimates.

Countries and surveys

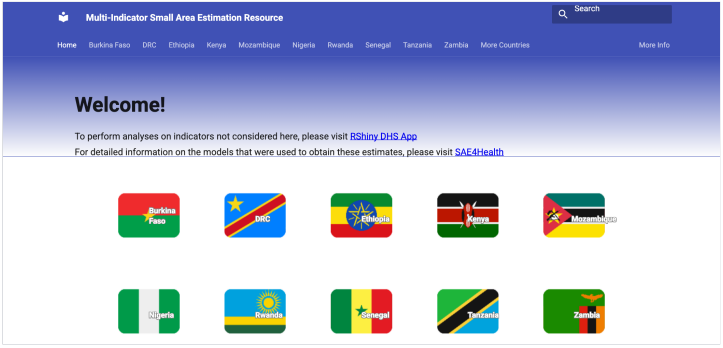
Country	Baseline	Latest	Admin-1 / Admin-2
Burkina Faso	2010	2021	13 / 45
DRC	2013	2023	26 / 189
Ethiopia	2019	2024	11 / 74
Kenya	2014	2022	47 / 290
Malawi	2015	2024	28 / 433
Mali	2018	2023	9 / 50
Mozambique	2011	2022	10 / 159

Country	Baseline	Latest	Admin-1 / Admin-2
Nigeria	2018	2024	37 / 774
Rwanda	2014–15	2019–20	5 / 30
Senegal	2019	2023	14 / 45
Sierra Leone	2013	2019	5 / 16
Tanzania	2015	2022	31 / 186
Zambia	2018	2024	10 / 116

- All are **DHS** surveys. Boundaries mostly come from **geoBoundaries**; Tanzania uses GADM, Sierra Leone WHO boundaries, Malawi Humdata.
- Nigeria's 774 LGAs from about 1,380 clusters is the sparsest Admin-2 setting on the site.

A tour of the website

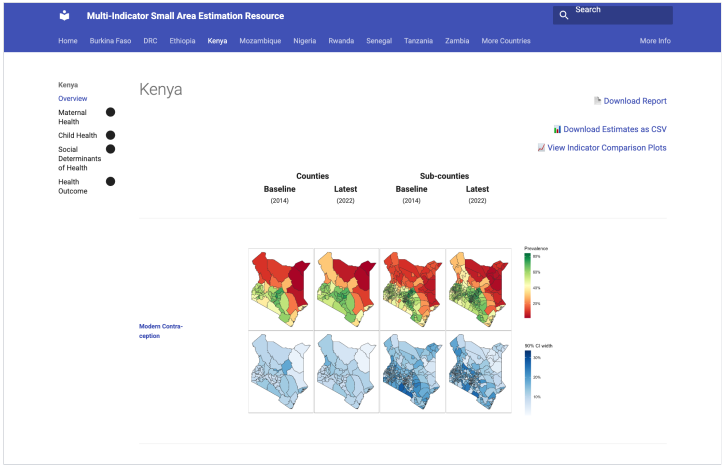
Home page



- One flag tile per main country; the top bar has the same list plus *More Countries* and *More Info* (methods, indicator definitions).
- Two links out: the **RShiny DHS App** for indicators not on the site, and **SAE4Health** for model details.
- Full-text **search** across all pages.

Screen grab of https://sae4lmic.stat.uw.edu/, November 2026.

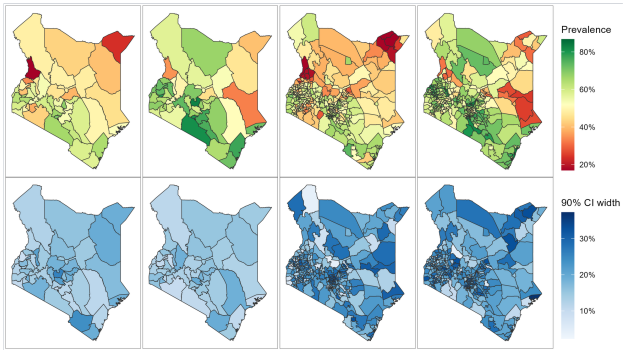
Country overview: every indicator on one page



- Left menu: the overview, then the four indicator groups.
- Top right: **Download Report** (PDF), **Download Estimates as CSV**, and **View Indicator Comparison Plots**, which opens the comparison app for this country.
- One row per indicator, the same layout for all 20, so the page scans quickly.

Screen grab of the Kenya overview page.

Anatomy of an overview row

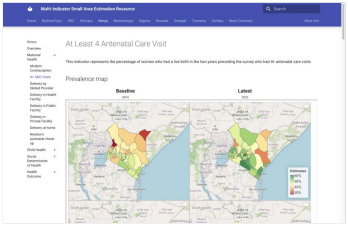


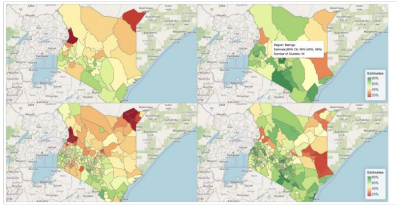
Columns: counties 2014, 2022; sub-counties 2014, 2022

- **Columns:** Admin-1 baseline and latest, then Admin-2 baseline and latest.
- **Top row:** prevalence, on a red–yellow–green scale shared by all four maps.
- **Bottom row:** width of the **90% interval**, in blues. Darker = more uncertain.
- Example: Kenya ANC4+. Coverage rose in most counties; the north and north-east remain lowest.

Read the two rows together: a dramatic colour on top means little if the same area is dark blue below.

Indicator page: interactive maps



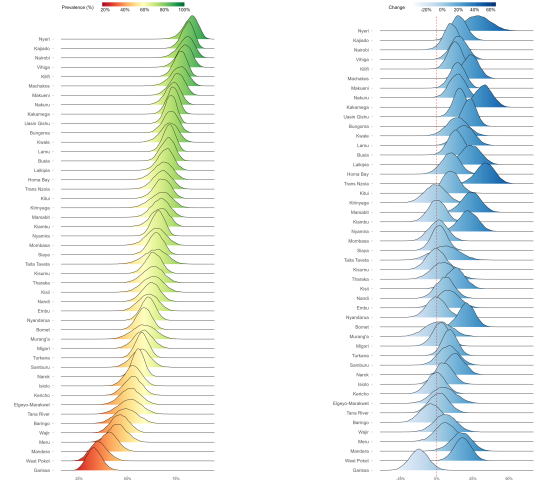


- Each indicator page starts with its **definition**, then the prevalence maps and the interval-width maps.
- The maps are **interactive** (Leaflet): pan and zoom, with all four panels moving together.
- Hover over an area to see its name, the **estimate with its 90% interval**, and the **number of clusters** behind it.
- Below the maps: ridge plots (next slide).

> Example tooltip: *Baringo, 49% (40%, 59%), 34 clusters.*

Screen grabs of the Kenya ANC4+ page and its interactive map (counties, 2014 and 2022).

Ridge plots: the whole distribution, and the change



Kenya ANC4+ ridge plots from the site, counties.

- **Left:** posterior distribution of ANC4+ in 2022 for each county, sorted. Nyeri is highest; Garissa is lowest.
- **Right:** distribution of the **change** since 2014. The red line marks no change.
- Most curves sit right of zero: coverage very likely rose. Where a curve straddles zero, the data cannot tell whether that county improved.
- The page shows the same pair for Admin-2 areas.

The 20 indicators

Maternal health

- Modern contraception (married women)
- 4+ antenatal care visits
- Delivery by a skilled provider
- Delivery in a health facility; public; private; at home
- Newborn postnatal check within 2 days

Child health

- MCV1 and DTP3 coverage; no vaccinations (12–23 months)
- ITN use, children under 5
- Diarrhoea treated with ORS or RHF

Social determinants of health

- Women who are literate
- Women who own a mobile phone
- Women with secondary or higher education
- Population in the lowest two wealth quintiles

Health outcomes

- Neonatal mortality
- Stunting and wasting, children under 5

> Availability varies slightly: Ethiopia, for example, has no ITN or mobile-phone pages.

Indicator definitions follow the DHS Program standard and are listed under More Info → Indicators.

Methods, in brief

- DHS surveys use a stratified two-stage cluster design, so estimates must be **survey-weighted**.
- **Admin-1:** weighted (direct) estimates. DHS surveys are designed to be reliable at this level.
- **Admin-2:** the **Fay–Herriot** model smooths the weighted estimates over space, borrowing strength from neighbouring areas to reduce uncertainty.
- National estimates are checked against the DHS API before publication.

How uncertainty is shown

- Interval-width maps use **90%** intervals.
- On the point-estimate maps, areas with **high uncertainty are hatched**.
- On the interval-width maps, areas whose uncertainty is ill-defined (sparse data) are **grey**.
- Ridge plots show the full distribution.

Details of each method: https://sae4health.stat.uw.edu/method/approach_overview/

Summarised from the site's More Info → Methodology page.

Downloads: reports and estimates

Country PDF report

- One report per country covering all indicators, for both survey rounds, with maps, intervals and ridge plots.
- Ready to print or share with people who will not browse the site.

CSV of all estimates

- One row per indicator × area × year × admin level, with the mean and interval bounds.
- The same files feed the comparison app, so numbers match across tools.

> Report the interval with the estimate wherever you reuse these numbers. The CSV makes this easy, and it is the main thing that separates a model-based estimate from a guess.

Both are hosted as GitHub release files and linked from each country's overview page.

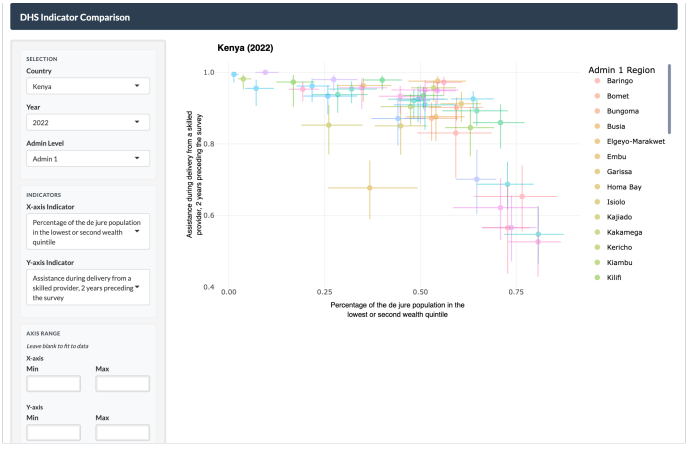
The indicator comparison app

Why compare indicators?

- The site shows indicators **one at a time**. Many questions are about **two**: are poorer areas also those with fewer skilled births? Does women's education track antenatal care?
- The comparison app plots **any two indicators** against each other, one point per area, using the site's pre-computed estimates.
- It does **no new modelling**. It is a lens on the published numbers.
- Open it from *View Indicator Comparison Plots* on a country overview; the link carries the country (`?country=Kenya`).

Good for: spotting outlying areas, generating hypotheses, and checking that related indicators behave consistently (e.g. facility delivery vs skilled attendance).

The app at a glance



Screen grab: Kenya 2022, counties. X: population in the lowest two wealth quintiles; Y: delivery assisted by a skilled provider.

Interactive (plotly) view.

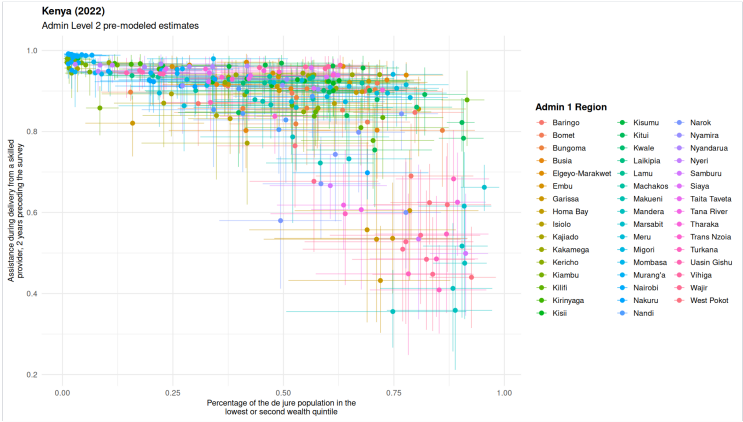
Controls



Section	What it does
Selection	Country, survey year and admin level. Only years and levels present in the data are offered.
Indicators	X and Y indicators, listed by their full DHS descriptions. The two must differ.
Axis range	Optional min/max per axis; blank fits the data.
Display options	Interval bars on/off; interactive (hover) or static plot; log scale on either axis.
Download	The current plot as a PDF, named after country, year, indicators and level.

- Points are **coloured by Admin-1 region**, so at Admin-2 you can see whether sub-areas of one region cluster together.
- Hovering shows the area name(s) and both means.

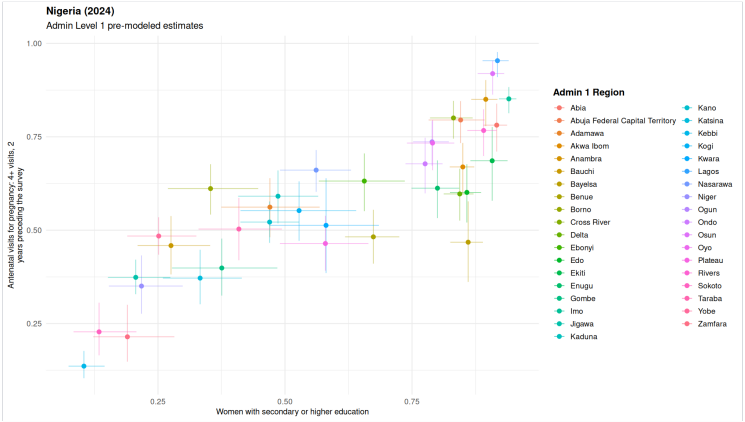
Example: wealth and skilled birth attendance, Kenya sub-counties



- Where few people are in the poorest two quintiles, skilled attendance is close to 100%.
- Above about 50% poor, attendance falls and spreads out, below 50% in some sub-counties.
- The crosses are wide: at Admin-2 both indicators are uncertain, so individual points should not be over-read.

Static view of the comparison app, Kenya 2022, Admin-2.

Example: women's education and ANC4+, Nigeria states



- A strong positive relationship: states where more women have secondary education have higher ANC4+ coverage.
- Most states line up along a rising trend, from about 15% to over 90% ANC4+.
- A few states sit well below the trend at their education level, which is worth a closer look.

Static view of the comparison app, Nigeria 2024, Admin-1.

Reading comparison plots carefully

What the plot can say

- Which areas are high or low on both indicators.
- Whether two indicators move together across areas.
- Which areas sit far from the general pattern.

What it cannot say

- **Causation**: education may not *cause* higher ANC use.
- **Individual** relationships: an area-level pattern need not hold for women within areas (the ecological fallacy).
- Small differences between points with overlapping bars.

- Both axes are **estimates**: keep the interval bars on when presenting.
- Use the **log scale** for skewed indicators such as neonatal mortality.
- Indicators with different denominators (e.g. births in the last 2 vs 5 years) cover slightly different populations.

Where each tool fits

Three tools, three jobs

	sae4lmic website	Indicator comparison app	DHS / MICS apps
Question	What is the estimate here, and how sure are we?	How do two indicators relate across areas?	Can I estimate a new indicator or country?
Who	Programme staff, partners, the public	Analysts, researchers	Analysts with survey data access
Modelling	Done by the team, checked	None (reuses the site's estimates)	Done by the user, guided
Coverage	13 countries, 20 indicators, 2 rounds	14 countries, latest round	DHS app: 60 countries, 150+ indicators
Output	Maps, ridge plots, PDF, CSV	Scatter plot, PDF	Maps, plots, tables, PDF report

Start on the website. Use the comparison app when the question involves two indicators. Go to the DHS app when the indicator or country you need is not on the site.

Limitations, and what could come next

Limitations to state

- DHS only; no MICS or MIS results yet.
- Two or three survey rounds per country, so no trend modelling between them.
- Boundaries change between rounds (e.g. Ethiopia); the site uses one boundary set per country.
- The comparison app currently offers the latest round only.

Possible next steps

- More countries and indicators.
- Change-over-time comparisons in the comparison app.
- Linked views: click a point, see the area on a map.
- User-selected dashboards built from the same CSVs.

Resources

- **sae4lmic website:** https://sae4lmic.stat.uw.edu/
- **Indicator comparison app:** https://rsc.stat.washington.edu/app_direct/indicatorcomparison/?country=Kenya
- **Comparison app source:** https://github.com/victoriaknutson/IndicatorComparison
- **Website source:** https://github.com/UW-Statistics/gatesweb **Pipeline:** https://github.com/richardli/SAE4LMIC
- **Methods and the modelling apps:** https://sae4health.stat.uw.edu/
- **DHS indicator definitions:** https://dhsprogram.com/data/