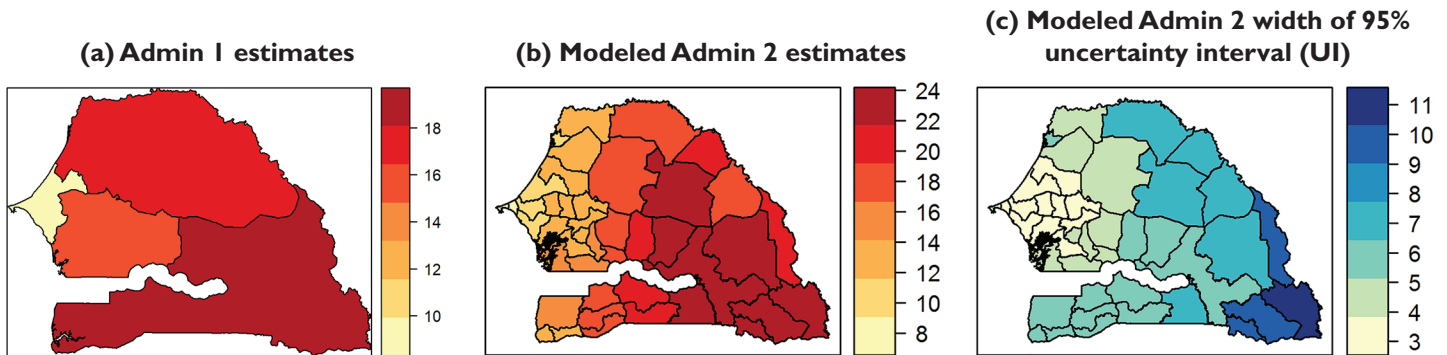# What are modeled Admin 2 estimates?

The DHS Program's surveys provide estimates for indicators at the first subnational administrative level (Admin 1), often referred to as provinces or regions (**Figure 1a**). But indicator estimates at this level can obscure inequalities that exist at the smaller second subnational administrative level (Admin 2), often referred to as districts or municipalities. By using a geospatial modeling approach, The DHS Program can produce modeled Admin 2 estimates (**Figure 1b**) and an associated uncertainty metric (**Figure 1c**).

Figure 1   Percentage of children under age 5 classified as underweight in Senegal, 2019 DHS

(a) Admin 1 estimates

(b) Modeled Admin 2 estimates

(c) Modeled Admin 2 width of 95% uncertainty interval (UI)

How are modeled Admin 2 estimates produced?

The DHS Program produces modeled Admin 2 estimates using a Bayesian model-based geostatistics (MBG) approach. This approach leverages the spatial relationship between survey clusters and the relationship with environmental and socioeconomic covariates to predict DHS indicators in areas that were not surveyed. The model produces pixel-level indicator estimates at a resolution of 5 × 5 km. This output is then aggregated using a population-weighted approach to the Admin 2 level.

Why produce modeled Admin 2 estimates?

Constrained by limited resources, program planning needs to ensure that small geographic areas are targeted effectively. As program planning and implementation often occur at the Admin 2 level, modeling indicators at this level provides a reliable smaller area estimate that can overcome the financial, human resource, time, and quality costs associated with increasing the survey sample size.

Why are more disaggregated data for nutrition needed?

Strengthening countries' nutrition policies and programs is essential to achieving the Sustainable Development Goals (SDG) for maternal and child malnutrition by 2030. Currently, many countries are not on track to meet the global nutrition targets for child stunting, wasting, and overweight; anemia in women of reproductive age; and overweight and obesity in adults.[1]

Developing informed program and policy responses requires reviewing the nutrition situation nationally and subnationally. This involves examining the relevant nutrition indicators and other nutrition-sensitive and related contextual indicators to build robust responses that allow for impact to be monitored and assessed. While national-level data are helpful at indicating the extent to which a problem exists in a country, more granular data are needed to more effectively target programs.

Where can users find Admin 2 estimates for other indicators?

Currently, The DHS Program produces Admin 2 estimates for indicators upon request. However, there are plans to routinely produce Admin 2 estimates for multiple indicators. The current proposed indicators are listed in **Table 1**, although this list is subject to change. Also, countries are not limited by this list and can request Admin 2 estimates for additional indicators before survey release. All modeled indicators, whether on the list or requested, will be included in a separate report to be published concurrent with survey release.

In the meantime, users can examine the Admin 1 estimates from DHS final reports and STATcompiler. Also, currently available on The DHS Program Spatial Data Repository website are modeled surface estimates produced using a similar method to the one described in this brief. However, these estimates are for 5 × 5 km squares throughout a country rather than administrative boundaries such as Admin 2; such fine-scale data may not be as useful for decision-making.

Table 1   Proposed list of indicators to be routinely modeled at Admin 2 level

Indicators	
Stunting	Women's education
Children with any anemia	Insecticide-treated net (ITN) availability
Children with DPT3 vaccine	Artemisinin-based combination therapy (ACT) use
Children with all basic vaccinations	Basic access to drinking water
Diarrhea treatment	Open defecation
Modern contraceptive prevalence rate	Basic toilet service
Unmet need for family planning	Intimate partner violence
Facility delivery	Under-5 mortality
Antenatal care: 4+ visits	Discriminatory attitudes towards people living with HIV/AIDS

How can modeled Admin 2 estimates be interpreted?

Modeled Admin 2 estimates can be interpreted in the same way as the Admin 1 subnational estimates already included in The DHS Program's surveys. As with the Admin 1 estimates, modeled Admin 2 estimates are given as rates or percentages with an uncertainty interval or confidence interval representing the degree of confidence in the estimate.

All statistical and modeled point estimates have an associated degree of uncertainty. The uncertainty associated with the Admin 2 estimates is quantified using the width of the 95% uncertainty intervals. The data user can be highly confident that the true value of the indicator falls between the lower and upper values. For example, if an estimate is 30% and the associated width of the uncertainty interval is 10%, then users can be 95% certain that the true value falls approximately between 25% and 35%. Users can review the specific lower and upper bounds of any specific uncertainty interval in the tables that accompany the maps.

In general, wider uncertainty intervals indicate greater uncertainty, while narrower uncertainty intervals indicate less uncertainty about the estimates. This can be seen in the map (**Figure 1c**) above, where there is more uncertainty in the wider 95% uncertainty intervals, which is depicted in darker blue in the maps. Areas with less uncertainty about the Admin 2 estimates will have a narrower 95% uncertainty interval, which is shown in the yellow and light green on the maps.

Different areas in a country may have different levels of uncertainty because of the ability of the model to predict the correct value of an indicator in a particular location. There are several factors that affect how well the model can predict estimates such as the number of cluster locations in the survey, the density of the clusters around a prediction location, the number of case count respondents within each cluster, the strength of correlations between covariates and the indicator, and the inherent degree of spatial variation displayed by the indicator.[2]

For users, understanding the uncertainty of the estimates is important for decision-making. More caution is required when using estimates with high uncertainty intervals for decision-making.

A more detailed explanation of the interpretation of the modeled estimates and their associated uncertainty can be found in *DHS Spatial Analysis Report 20 (SAR 20)*.

How can modeled Admin 2 estimates be used?

Admin 2 estimates are a useful tool in evaluating geographic disparities within Admin 1 and national boundaries. When Admin 2 estimates are produced for multiple surveys over time, program planners can see how indicators change for individual Admin 2s, making the estimates a useful tool for monitoring and evaluating subnational progress. (See *SAR 20* for a detailed explanation of the use of Admin 2 estimates.)

Policymakers and program planners can use Admin 2 estimates in the following ways:

- Ranking Admin 2 estimates
  - Admin 2s can be ranked from the most vulnerable to the least vulnerable. This information can then be examined in context and used to target smaller geographic areas for intervention. For example, policymakers might consider targeting resources to the most vulnerable districts.
  - These rankings can also inform research questions. Policymakers might want to investigate the differences between the most and least vulnerable districts to understand the factors driving these differing results. The outcomes of this research could be used to inform policymakers on the factors that need to be changed to improve districts with the worst outcomes.
- Comparing Admin 2 estimates to Admin 1 or national averages.
  - Admin 2s can be categorized into those falling above or below the national or Admin 1 averages. This allows policymakers to see which districts are performing relatively better or worse.
- Comparing Admin 2 estimates over time
  - Admin 2 estimates from multiple surveys can be compared over time to monitor subnational progress. This information would be particularly useful for district-level program planners in gauging and monitoring their district's performance over time.

Example case study: using Admin 2 estimates for policymaking

Countries can use Admin 2 estimates for many purposes. In this case study, a policymaker working at the national level in Senegal has received the following Admin 1 and Admin 2 estimates on the percentage of children under age 5 classified as underweight. The policymaker might note that when comparing the Admin 1 and Admin 2 maps visually, the variation between Admin 2s (**Figure 2b**) is not available in the Admin 1 map (**Figure 2a**). He or she might also note that in the southeast there is more uncertainty in the estimates relative to the northwest (**Figure 2c**). However, looking at the level of uncertainty across the country, it is not unreasonably high in any Admin 2 so the policymaker can be comfortable using these data for decision-making.

Figure 2   Percentage of children under age 5 classified as underweight in Senegal, 2019 DHS
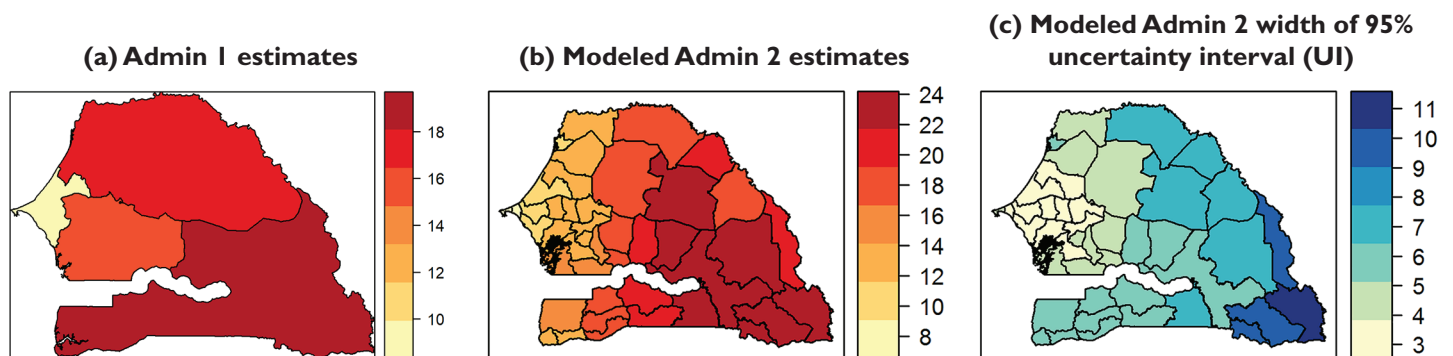
Next, the policymaker reviews the data table of the Admin 2 estimates and decides to rank them from lowest to highest underweight estimates. **Table 2** shows the underweight estimates, lower and upper 95% uncertainty interval, and width of the uncertainty interval for the 10 most and least vulnerable Admin 2s within Senegal.

The policymaker might first note the wide disparity between the least vulnerable district (with an estimate of 8%) and the most vulnerable district (with an estimate of 23%). The policymaker could then decide to examine the other Admin 2 maps for wasting and stunting to understand the nutritional status of children more broadly and look to see if the same districts are more or less vulnerable. Next, the policymaker might examine other immediate, underlying, and enabling factors according to UNICEF's Conceptual Framework on the Determinants of Maternal and Child Nutrition to better understand factors contributing to the underweight rankings. For example, he or she could use STATcompiler to examine indicators such as dietary diversity for children and breastfeeding practices, recent infection or illness, parental education, environmental conditions, and more. Although STATcompiler provides only Admin 1 estimates, the information at the region level is still helpful for understanding the context. Similarly, the policymaker could also examine contextual factors coming from other sources such as District Health Information Systems (DHIS2) or Health Management Information Systems (HMIS) that may be aggregated at the Admin 1 or Admin 2 levels.

After reviewing all of these data, the policymaker can then develop informed strategies to improve underweight across the country and specifically target the most vulnerable Admin 2s. Actions could include scaling up existing interventions and working with multiple sectors such as agriculture, health, education, and water, sanitation, and hygiene to improve the situation.

Table 2   **Ranked Admin 2 estimates and uncertainty intervals (UI) for percentage of children under age 5 classified as undereweight in Senegal, 2019 DHS**

		Least vulnerable Admin 2s					Most vulnerable Admin 2s			
Rank	Admin 1	Admin 2	Percentage	UI Lower	UI Upper	Rank	Admin 1	Admin 2	Percentage	UI Lower	UI Upper
1.	Dakar	Dakar	7.6	5.8	10.0	34.	Tambacounda	Bakel	21.1	16.8	25.9
2.	Dakar	Rufisque	8.4	6.7	10.3	35.	Kolda	Medina yoro foula	21.3	18.8	24.1
3.	Saint louis	Saint louis	10.0	7.6	12.9	36.	Tambacounda	Tambacounda	21.8	18.8	25.1
4.	Thies	Thies	10.1	8.6	11.7	37.	Kedougou	Kedougou	21.9	17.2	27.2
5.	Thies	Mbour	10.6	9.1	12.5	38.	Kolda	Velingara	22.2	18.8	25.7
6.	Thies	Tivaoune	11.4	9.9	13.0	39.	Matam	Ranerou	22.4	19.2	25.7
7.	Fatick	Fatick	11.6	10.0	13.5	40.	Kedougou	Saraya	22.5	17.4	28.5
8.	Diourbel	Bambey	11.6	10.1	13.4	41.	Tambacounda	Koupentoum	22.6	19.7	25.9
9.	Kaolack	Kaolack	11.8	10.1	13.8	42.	Tambacounda	Goudiry	23.0	19.3	27.0
10.	Ziguinchor	Ziguinchor	12.0	9.4	15.0	43.	Kedougou	Salemata	23.1	18.4	28.4

Where can I find the child undernutrition Admin 2 maps?

The maps are available on the DHS Program website here. This document provides Admin 1 and Admin 2 level estimates of child stunting, wasting, and underweight at the Admin 1 and Admin 2 levels for 21 USAID nutrition priority countries. In addition, tables with the Admin 2 estimates, and the lower and upper 95% uncertainty intervals are provided.

Further Resources

For more information on the modeling process, see:

Mayala, B. K., T. Dontamsetti, T. D. Fish, and T. N. Croft. 2019. *Interpolation of DHS Survey Data at Subnational Administrative Level 2.* DHS Spatial Analysis Reports No. 17. Rockville, Maryland, USA: ICF. https://dhsprogram.com/pubs/pdf/SAR17/SAR17.pdf

For more information on the use of Admin 2 estimates, see:

Janocha, B., R. E. Donohue, T. D. Fish, B. K. Mayala, and T. N. Croft. 2021. *Guidance and Recommendations for the Use of Indicator Estimates at Subnational Administrative Level 2.* DHS Spatial Analysis Reports No. 20. Rockville, Maryland, USA: ICF. https://dhsprogram.com/pubs/pdf/SAR20/SAR20.pdf

References

[1] *2021 Global Nutrition Report: The state of global nutrition.* Bristol, UK: Development Initiatives. https://globalnutritionreport.org

[2] Burgert-Brucker, Clara R., Trinadh Dontamsetti, Aileen M. J. Marshall, and Peter W. Gething. 2016. *Guidance for Use of The DHS Program Modeled Map Surfaces.* DHS Spatial Analysis Reports No. 14. Rockville, Maryland, USA: ICF International. https://dhsprogram.com/pubs/pdf/SAR14/SAR14.pdf