Analyzing Girl Child Marriage: Senegal Deep Dive

Prepared for the Child Marriage Learning Partners Consortium

With Support from the Bill & Melinda Gates Foundation

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About Fraym

MAPPING
HUMANITY

We use advanced machine learning models to produce unprecedented, local information on human and population characteristics in critical geographies around the world—down to $1km^2$ even in remote areas.

Fraym has built machine learning (ML) software that weaves together geo-tagged household survey data with satellite imagery to create localized population information (1 km^2).
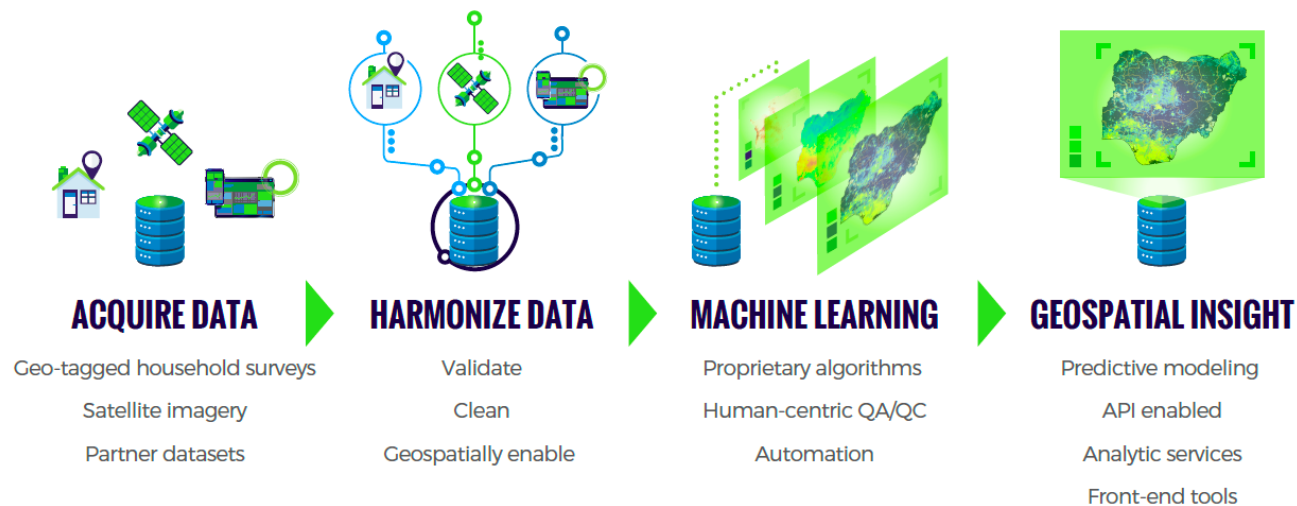
1 The primary ML model input is data from high-quality, geo-tagged household surveys. Key indications of a high-quality household survey include implementing organization(s), sample design, sample size, and response rates. After data collection, *post-hoc* sampling weights are created to account for any oversampling and ensure representativeness.

2 The second major data input is satellite imagery and related derived data products, including earth observation (EO) data, gridded population information (e.g., human settlement mapping, etc.), proximity to physical locations (e.g., health clinics, ports, roads, etc.) and biophysical surfaces like soil characteristics. As with the survey data, Fraym data scientists ensure that the software only uses high-quality imagery and derivative inputs.

3 To create spatial layers from household survey data, Fraym leverages machine learning to predict an indicator of interest at a 1 square kilometer resolution. This methodology builds upon existing, tested methodologies for interpolation of spatial data. The resulting model is used to predict the survey data for all non-enumerated areas. A similar approach was originally developed by academic researchers focused on health outcomes, which were expanded upon by USAID's Demographic and Health Surveys program since then by Fraym and others.[1]

ACQUIRE DATA	HARMONIZE DATA	MACHINE LEARNING	GEOSPATIAL INSIGHT
Geo-tagged household surveys	Validate	Proprietary algorithms	Predictive modeling
Satellite imagery	Clean	Human-centric QA/QC	API enabled
Partner datasets	Geospatially enable	Automation	Analytic services
			Front-end tools

Note 1: Gething, Peter, Andy Tatem, Tom Bird, and Clara R. Burgert-Brucker. 2015. Creating Spatial Interpolation Surfaces with DHS Data DHS Spatial Analysis Reports No. 11. Rockville, Maryland, USA: ICF International. Other notable, relevant work includes: Weiss DJ, Lucas TCD, Nguyen M, et al. Mapping the global prevalence, incidence, and mortality of *Plasmodium falciparum*, 2000–17: a spatial and temporal modelling study. Lancet 2019 and Tatem A, Gething P, Pezzulo C, Weiss D, and Bhatt S. 2014. Final Report: Development of High-Resolution Gridded Poverty Surfaces. University of Southampton.
https://www.worldpop.org/resources/docs/pdf/Poverty-mapping-report.pdf

Report Overview

Fraym produced hyperlocal visualizations of girl child marriage prevalence and burden, community contexts, and potential risk factors to child marriage in Senegal.

1   Fraym **mapped the prevalence and burden of under-18 and under-15 girl child marriage and analyzed spatiotemporal trends** from 2005, 2011, and 2016 in Senegal.[1]

2   Additionally, Fraym assessed a variety of indicators that help to **illuminate community contexts and their relationship with child marriage prevalence**. Target community-level indicators include those that are more traditionally associated with child marriage, such as employment and education, as well as less explored factors, such as access to electricity or improved sanitation at home.

3   In order to assess the populations vulnerable to child marriage, Fraym **developed three profiles that capture potential risk factors based on a summary of available evidence and expert consultation**: (i) pregnancy before marriage; (ii) poverty; and (iii) gender-equitable attitudes and behaviors. Fraym then mapped these profiles to identify high risk communities and to estimate the number of at-risk girls between the ages of 10 and 14 years old.

4   Finally, Fraym conducted **hotspot analysis to more deeply explore areas** of high child marriage prevalence.

5   In addition to Senegal, Fraym used this same analytical framework to produce country reports for Bangladesh, Ethiopia, India, Kenya, Malawi, and Nigeria, as well as a cross-country synthesis report, as part of the Child Marriage Learning Partners Consortium.[2]

Note 1: There are more recent editions of the Demographic and Health Surveys for Senegal, however they were not geotagged at the level required for our analysis.
Note 2: Members of the Bill & Melinda Gates Foundation funded consortium include Fraym, Iris Group, Girls Not Brides, Population Council, Center on Gender Equity and Health, UNICEF, and Unchained at Last.

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REPORT OVERVIEW || KEY FINDINGS

The results of this report can help to inform policy, bolster advocacy, and further knowledge.

1. From 2005 to 2016, under-18 child marriage prevalence decreased, **with the largest decreases occurring between 2005 and 2011.** Some communities in Kolda and Louga that witnessed the largest changes, both improvements and deteriorations, are also communities with high prevalence.

2. Fraym **identified two regions as hotspots of child marriage for further analyis**: (i) Tambacounda; (ii) Kolda. Both regions have some of the highest prevalence rates in the country.

3. **Poverty represents the most important risk factor for child marriage in Senegal**, putting an estimated 225,000 girls aged 10 to 14 at risk for child marriage. Gender inequitable attitudes is also an important factor.

4. The relationship between child marriage and community characteristics is largely in accord with the existing literature.

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Mapping Prevalence and Burden

Fraym mapped the prevalence and burden of under-18 and under-15 child marriage and analyzed spatiotemporal trends spanning 2005 to 2016.

1 Fraym's analysis **focused primarily on the cohort of women aged 20 to 24**. Under-18 and under-15 child marriage prevalence is defined as the percent of women aged 20 to 24 at the time of survey enumeration who were married before age 18 and age 15, respectively.[1] Burden is the number of women who were married before age 18 and 15.

2 Using the most recently available geo-tagged household survey (2016), **Fraym mapped under-18 and under-15 child marriage prevalence and burden at the national, regional, departmental, and community level (1km²).**

3 Next, Fraym examined two previous survey intervals (2005 and 2011) in order to **assess spatiotemporal trends across the full time period (2005 to 2016), as well as in shorter intervals (2005 to 2011 and 2011 to 2016).**

4 This mapping and associated analysis can help researchers, policymakers, and other decision-makers to target their future activities and resource allocation.

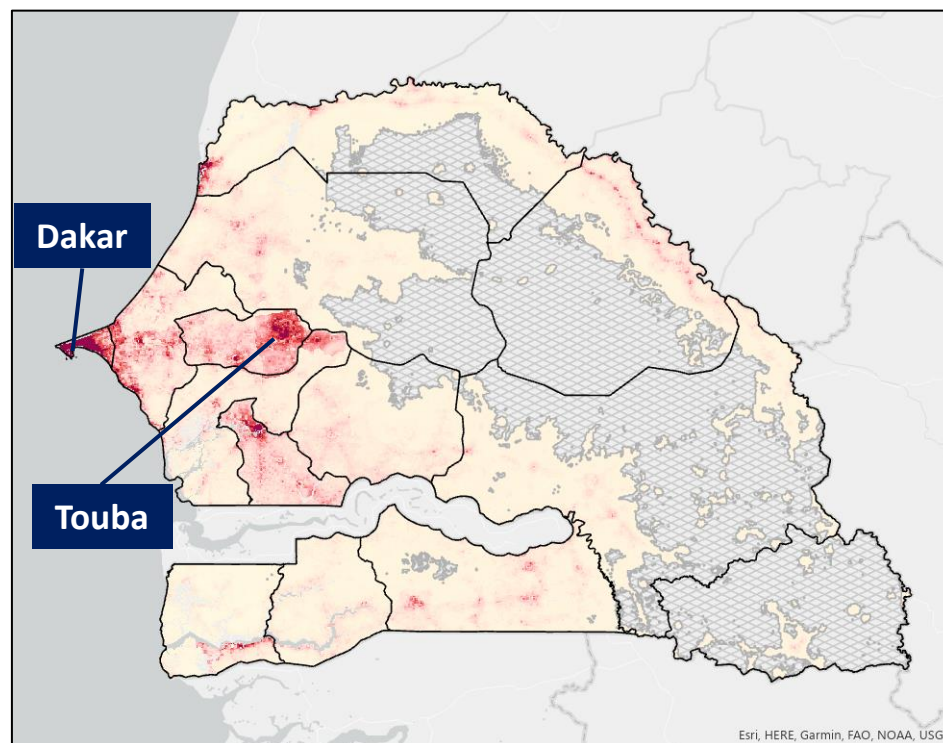**Note 1:** Please see the appendix for more detailed information on the definition.

MAPPING PREVALENCE AND BURDEN || UNDER-18 (2016)

Nationally, 35 percent of women aged 20-24, or 230,000 women, were married before age 18. Prevalence is highest in the central regions, whereas burden is more concentrated in population-dense cities.

Under-18 Prevalence
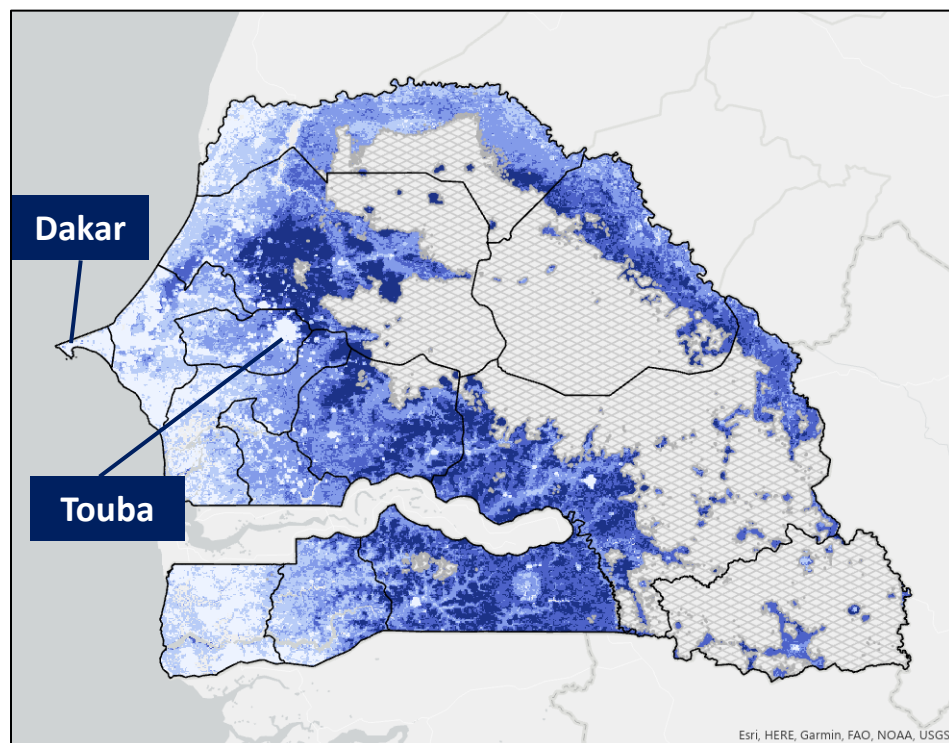
Under-18 Burden

Percent of women (aged 20-24) who were married before 18

0%   65%+

Areas with total population less than 10 people per sq km

City   Large cities

Number of women (aged 20-24) who were married before 18

0   500+

Nationally, under-18 child marriage rates in Senegal decreased between 2005 and 2016. Decreases are most notable in the South, whereas there is a significant concentration of increased rates in the North.
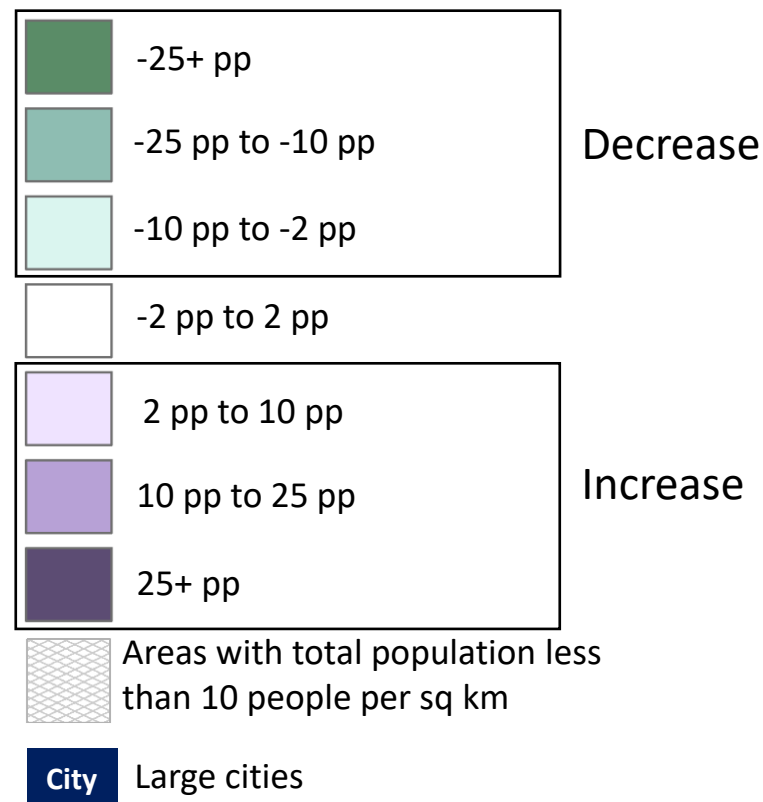
Change in the Prevalence of Under-18 Child Marriage: 2005 to 2016[1]

Touba

Dakar

Esri, HERE, Garmin, FAO, NOAA, USGS
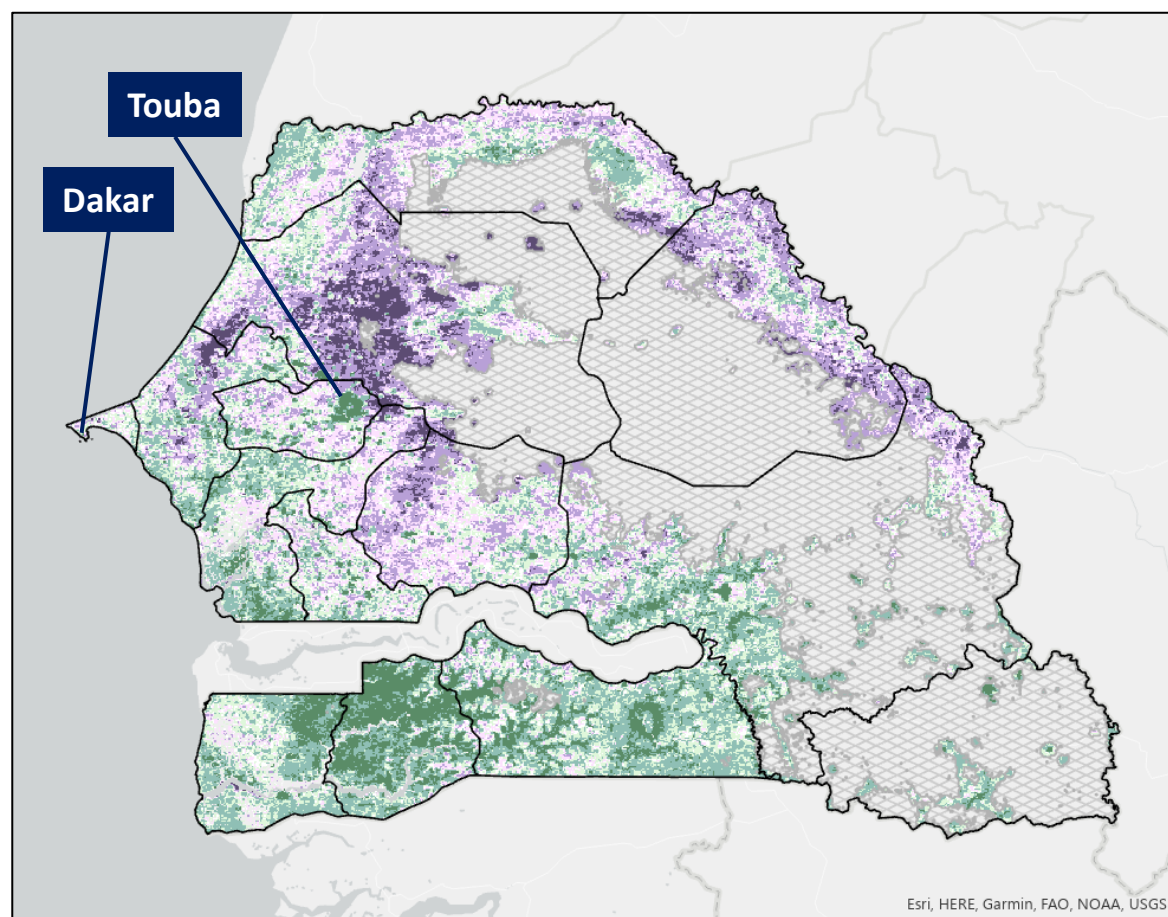
National Under-18 Prevalence

2005	2016
39.1%	34.9%

Percentage Point (pp) Change in Under 18 Prevalence from 2005 to 2016

-25+ pp	Decrease
-25 pp to -10 pp	
-10 pp to -2 pp	
-2 pp to 2 pp	
2 pp to 10 pp	Increase
10 pp to 25 pp	
25+ pp	

Areas with total population less than 10 people per sq km
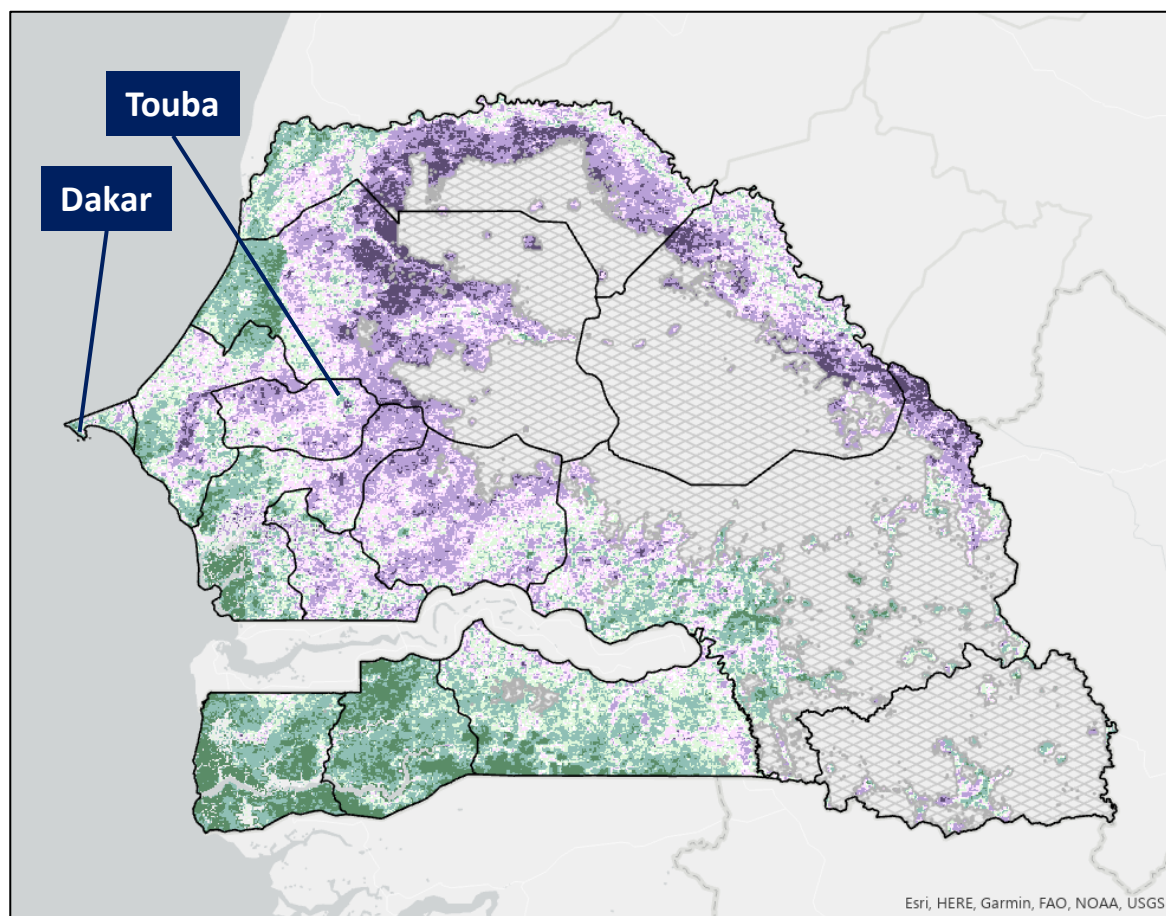
City Large cities

Note 1: Modeled estimates at the sq km level in 2016 for Ziguinchor do not meet Fraym quality standards. As a result, estimates in this region should be considered as less precise and interpreted with caution. Statistics for departments in this region are not presented.
Source: Fraym, Senegal DHS (2016 and 2005)

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From 2005 to 2011, the prevalence of under-18 child marriage decreased in the South and along the coast, whereas communities in the northeast witnessed increases.

Change in the Prevalence of Under-18 Child Marriage: 2005 to 2011

Touba

Dakar

Esri, HERE, Garmin, FAO, NOAA, USGS

National Under-18 Prevalence

2005	2011
39.1%	35.5%

Percentage Point (pp) Change in Under 18 Prevalence from 2005 to 2011

	-25+ pp	Decrease
	-25 pp to -10 pp	
	-10 pp to -2 pp	
	-2 pp to 2 pp	
	2 pp to 10 pp	Increase
	10 pp to 25 pp	
	25+ pp	

Areas with total population less than 10 people per sq km

City — Large cities

Source: Fraym, Senegal DHS (2011 and 2005)

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In the next phase of analysis (2011 – 2016), the decrease in under-18 child marriage was less prominent nationally, despite a handful of communities witnessing large changes.
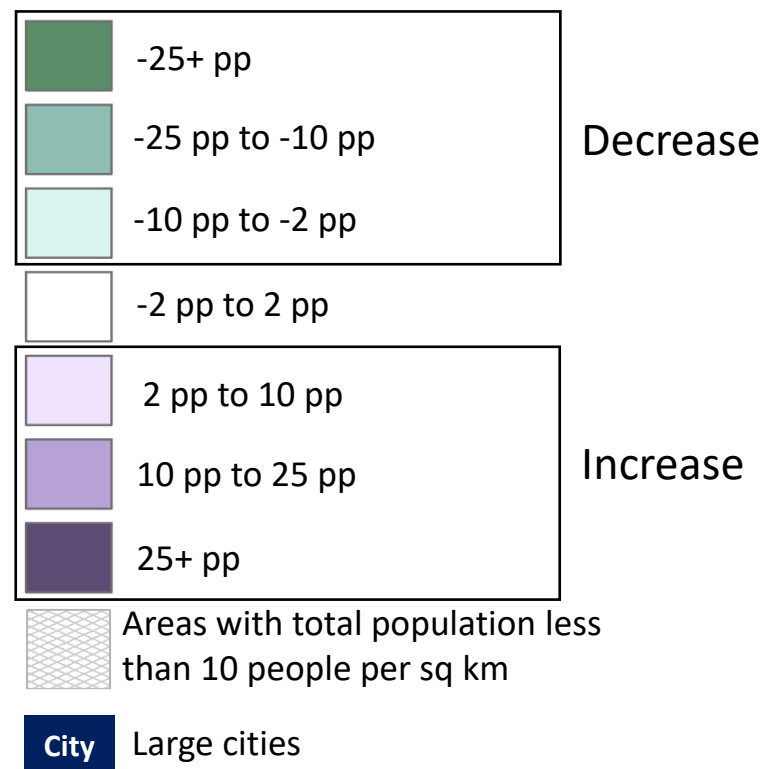
Change in the Prevalence of Under-18 Child Marriage: 2011 to 2016
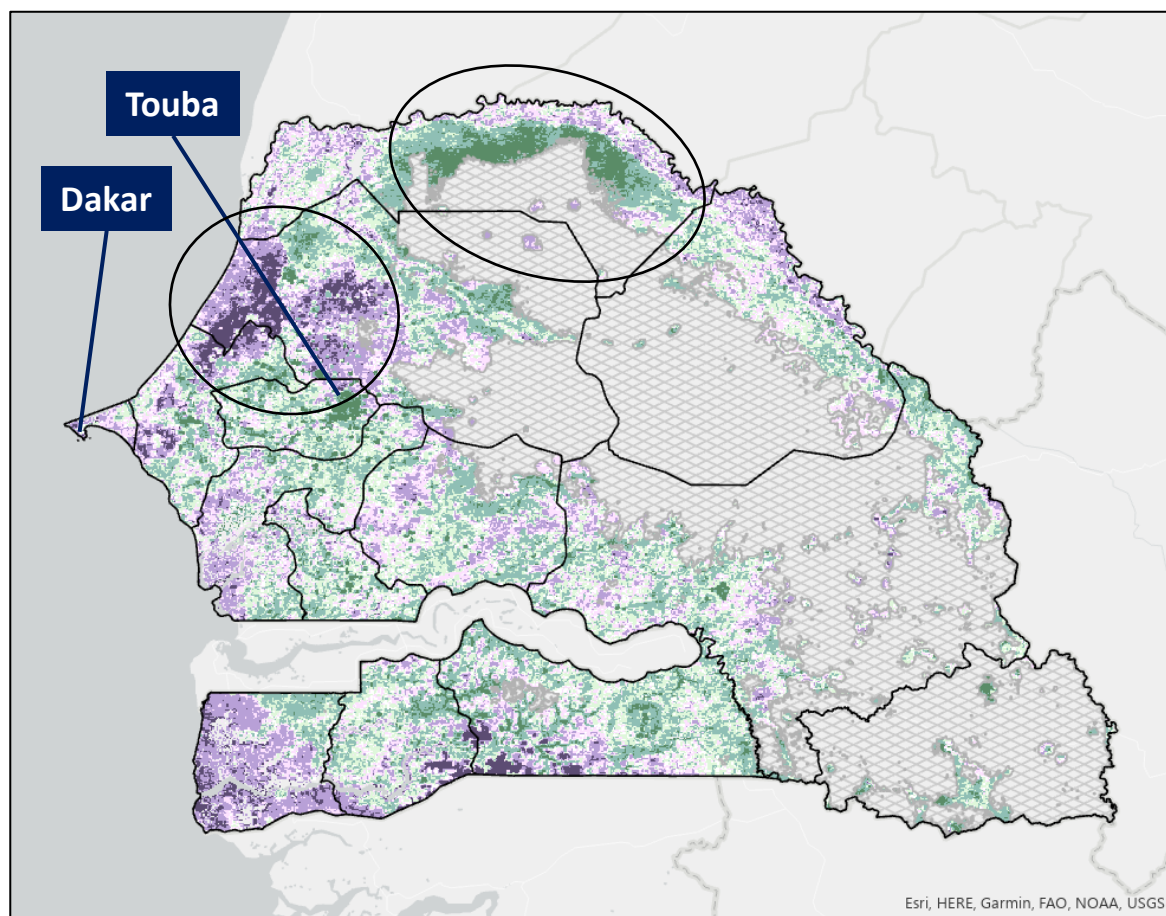
National Under-18 Prevalence

2011	2016
35.5%	34.9%

Percentage Point (pp) Change in Under 18 Prevalence from 2011 to 2016

Color	Range	
	-25+ pp	Decrease
	-25 pp to -10 pp	Decrease
	-10 pp to -2 pp	Decrease
	-2 pp to 2 pp	
	2 pp to 10 pp	Increase
	10 pp to 25 pp	Increase
	25+ pp	Increase

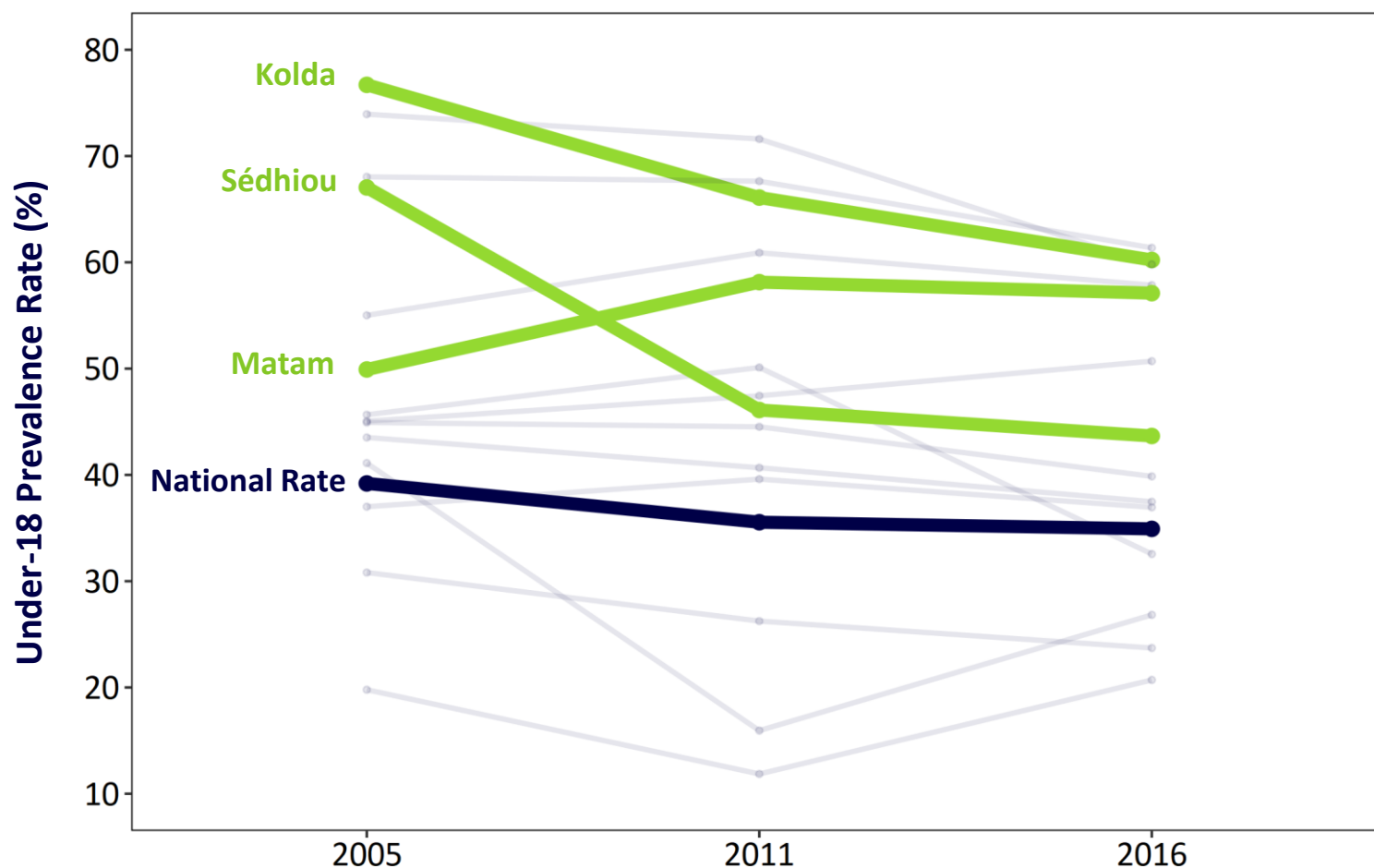Areas with total population less than 10 people per sq km

City Large cities

Note 1: Modeled estimates at the sq km level in 2016 for Ziguinchor do not meet Fraym quality standards. As a result, estimates in this region should be considered as less precise and interpreted with caution. Statistics for departments in this region are not presented.
Source: Fraym, Senegal DHS (2016 and 2011)

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At the regional level, under-18 prevalence rates decreased slightly. Kolda and Sédhiou saw the largest decreases from 2005 to 2016. Matam saw the largest increase out of the four regions that had child marriage prevalence rates increase.

Change in the Under-18 Child Marriage Prevalence Rate, by Region[1]

Note 1: Modeled estimates at the sq km level in 2016 for Ziguinchor do not meet Fraym quality standards. As a result, estimates in this region should be considered as less precise and interpreted with caution. Statistics for departments in this region are not presented.
Source: Fraym, Senegal DHS (2016, 2011, and 2005)

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MAPPING PREVALENCE AND BURDEN || DEPARTMENTS WITH LARGEST CHANGES

From 2005 to 2016, while several departments experienced *increases* (particularly in Linguére), there were 16 departments that experienced double-digit *decreases*.[1,2]

Largest Percentage Point **Increase** in Under-18 Prevalence (2005 to 2016)	
Linguére (Louga)	+ 13 pp
Birkelane (Kaffrine)	+ 7 pp
Kanel (Matam)	+ 7 pp
Ranérou Ferlo (Matam)	+ 7 pp
Matam (Matam)	+ 7 pp
Malem-Hodar (Kaffrine)	+ 5 pp
Podor (Saint-Louis)	+ 5 pp
Bakel (Tambacounda)	+ 4 pp

| Largest Percentage Point **Decrease** in Under-18 Prevalence (2005 to 2016)	
Bounkiling (Sédhiou)	- 30 pp
Sédhiou (Sédhiou)	- 24 pp
Saraya (Kédougou)	- 18 pp
Kolda (Kolda)	- 18 pp
Goudomp (Sédhiou)	- 17 pp
Vélingara (Kolda)	- 16 pp
Mbacké (Diourbel)	- 15 pp
Tambacounda (Tambacounda)	- 14 pp

Note 1: Fraym calculated the percentage point (pp) difference between 2005 and 2016 to determine whether a county witnessed an increase or decrease in under-18 prevalence. In the tables above, the region is listed in parentheses.
Source: Fraym, Senegal DHS (2016, 2005)

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Nationally, 9 percent of women aged 20-24, or 61,800 women, were married before age 15. Burden is concentrated primarily in Dakar and Touba, while prevalence rates remain higher in more rural areas.
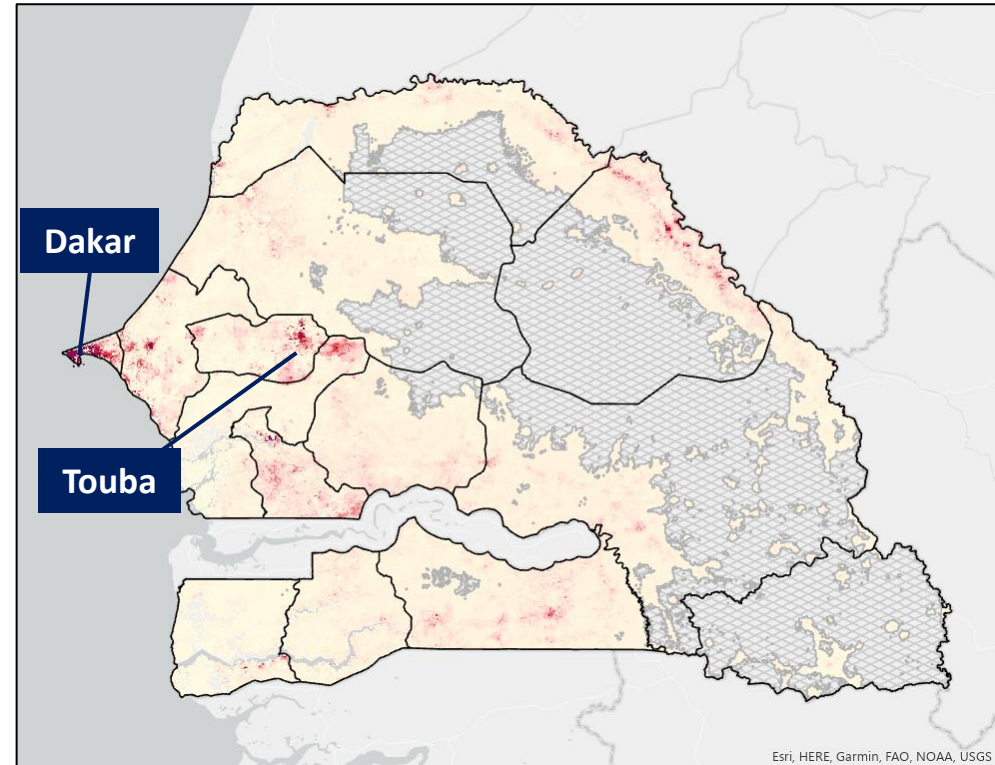
Under-15 Prevalence
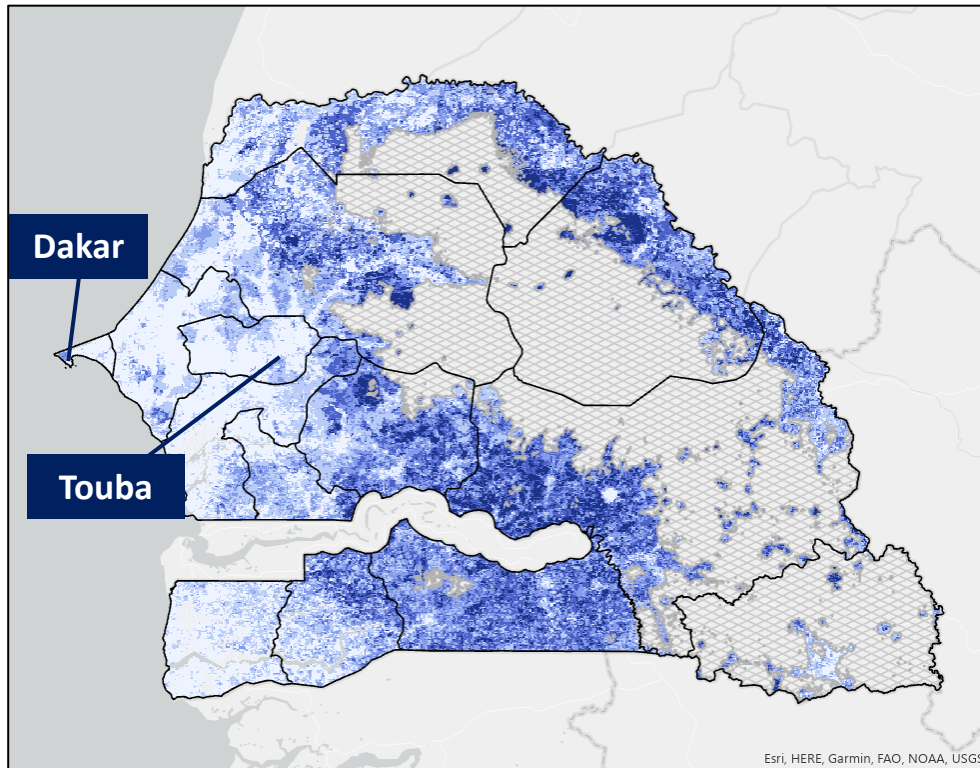
Dakar

Touba

Esri, HERE, Garmin, FAO, NOAA, USGS

Percent of women (aged 20-24) who were married before 15

0%   35%+

Areas with total population less than 10 people per sq km

Under-15 Burden

Dakar

Touba

Esri, HERE, Garmin, FAO, NOAA, USGS

Number of women (aged 20-24) who were married before 15

0   200+

City Large cities

Source: Fraym, Senegal DHS 2016

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From 2005 to 2016, communities on average witnessed a slight decrease in under-15 prevalence, especially in the west. Still, there were some pockets with increases.
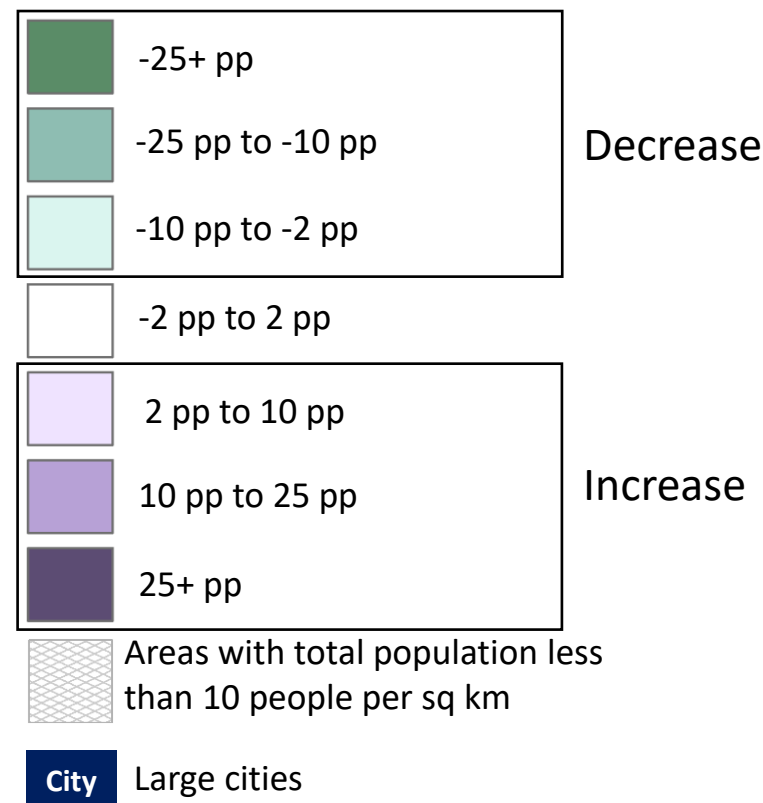
Change in the Prevalence of Under-15 Child Marriage: 2005 to 2016
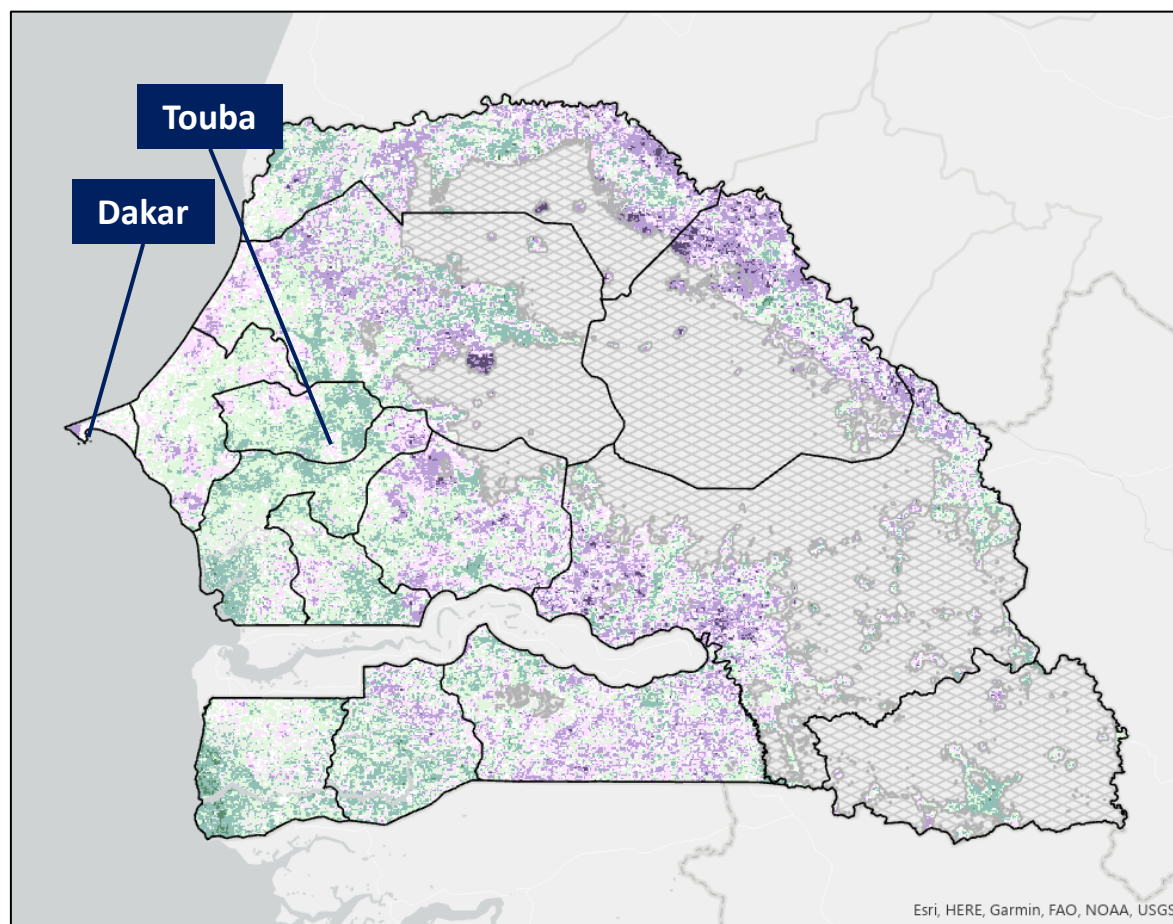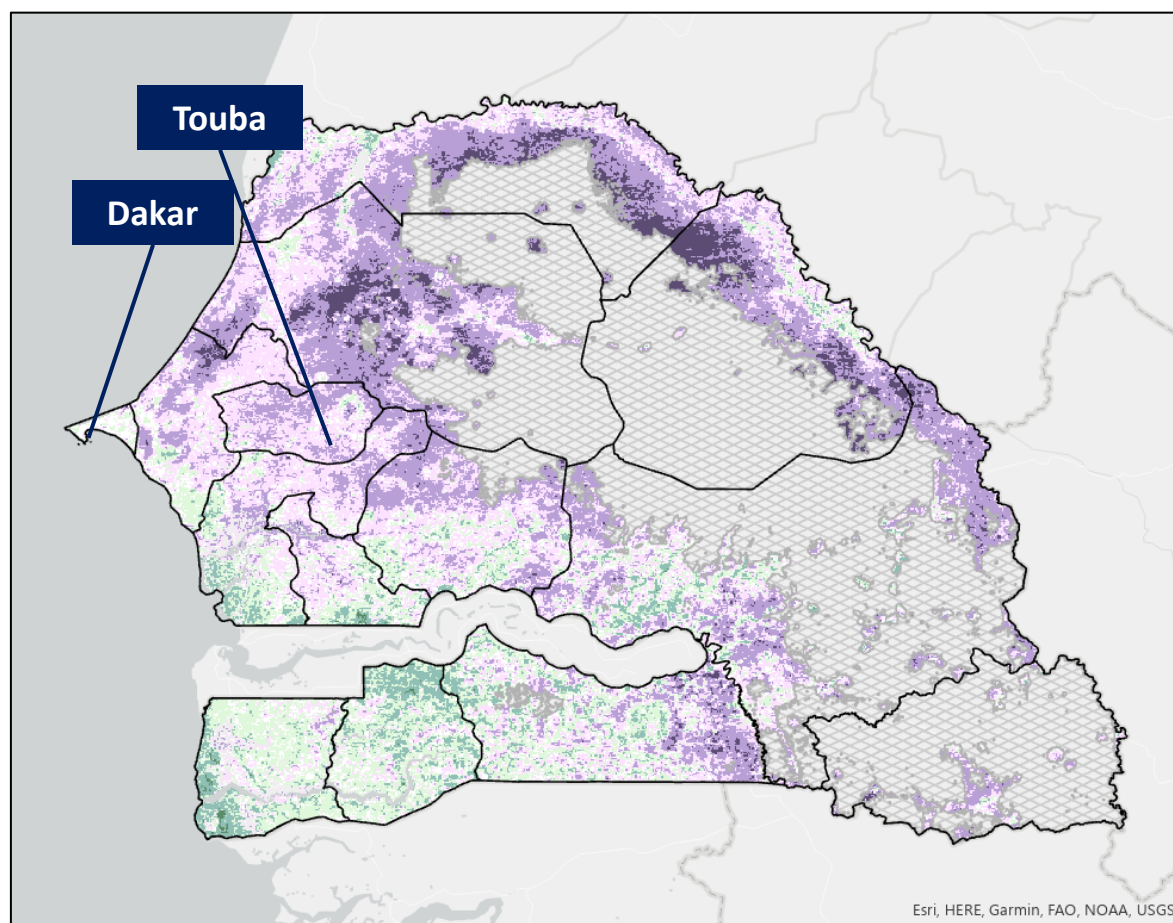

National Under-15 Prevalence

2005	2016
9.9%	9.3%

Percentage Point (pp) Change in Under-15 Prevalence from 2005 to 2016

-25+ pp	
-25 pp to -10 pp	Decrease
-10 pp to -2 pp	

-2 pp to 2 pp

2 pp to 10 pp	
10 pp to 25 pp	Increase
25+ pp	

Areas with total population less than 10 people per sq km

City   Large cities

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In the first phase of analysis (2005 to 2011), most communities, except a few areas in the southwest, experienced a slight increase in under-15 prevalence rates.
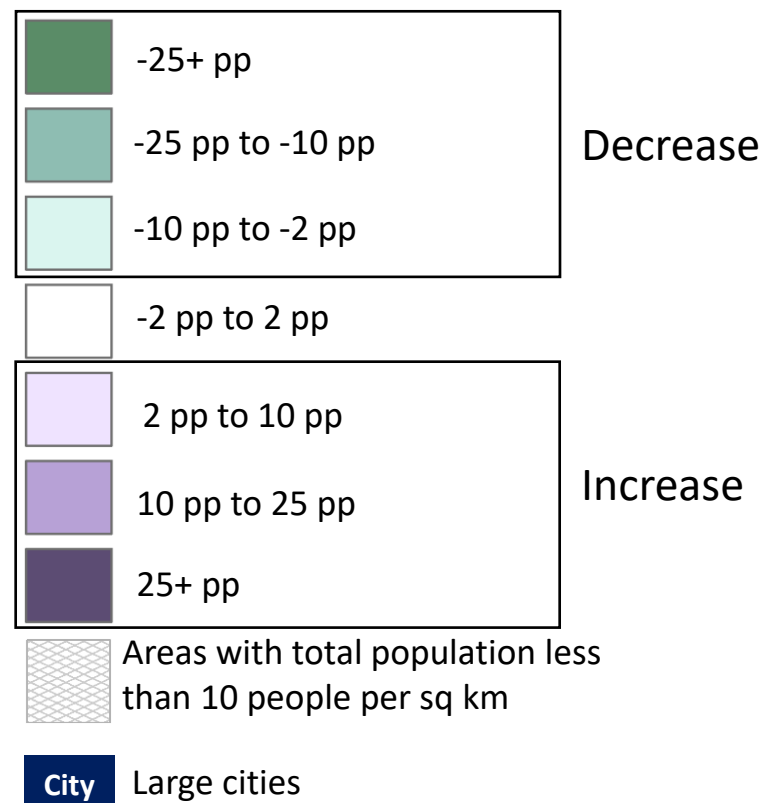
Change in the Prevalence of Under-15 Child Marriage: 2005 to 2011

National Under-15 Prevalence

2005	2011
9.9%	13.6%

Percentage Point (pp) Change in Under-15 Prevalence from 2005 to 2011

-25+ pp	Decrease
-25 pp to -10 pp	
-10 pp to -2 pp	
-2 pp to 2 pp	
2 pp to 10 pp	Increase
10 pp to 25 pp	
25+ pp	

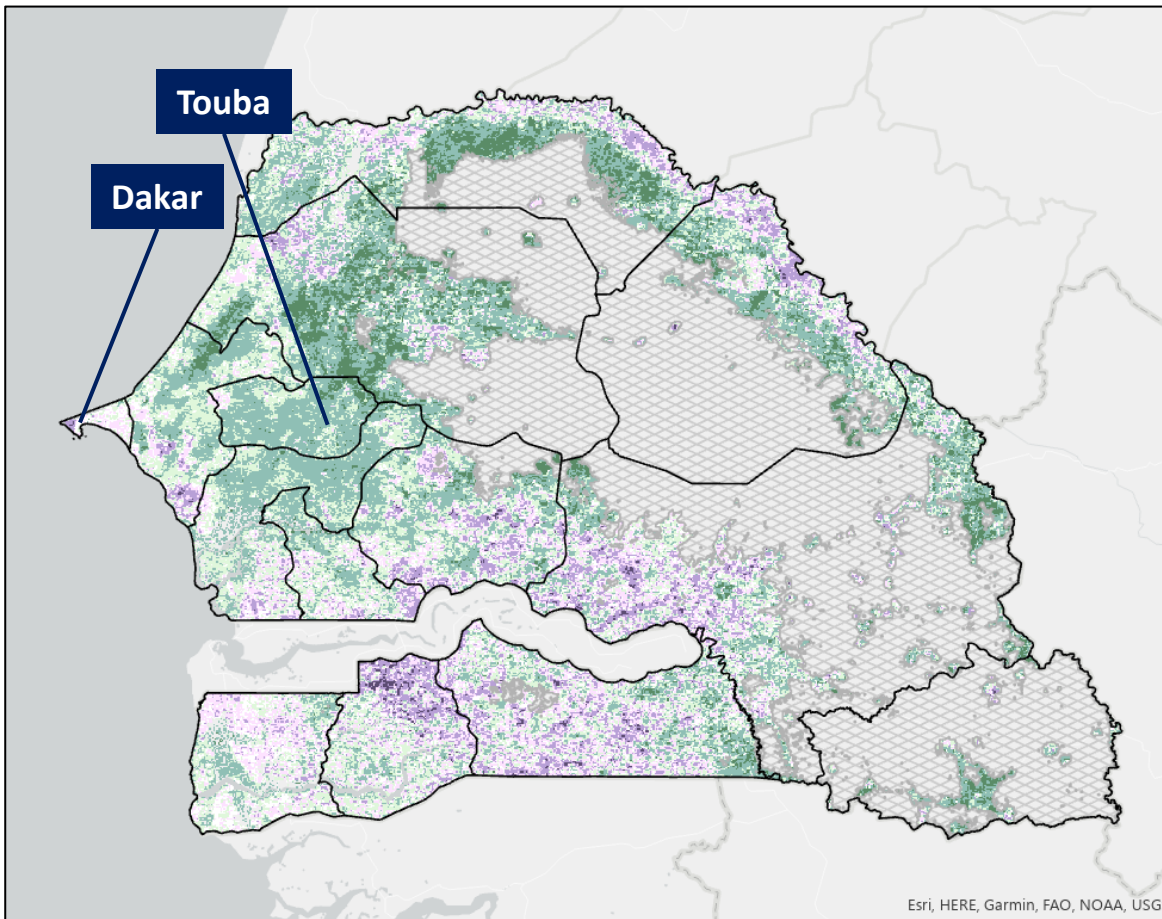Areas with total population less than 10 people per sq km

City Large cities

Note 1: Modeled estimates at the sq km level in 2005 for Saint Louis do not meet Fraym quality standards. As a result, estimates in this region should be considered as less precise and interpreted with caution. Statistics for departments in this region are not presented.
Source: Fraym, Senegal DHS (2011 and 2005)

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Across Senegal, the prevalence of under-15 child marriage declined from 2011 to 2016, with many communities reversing the trend of the previous time interval.
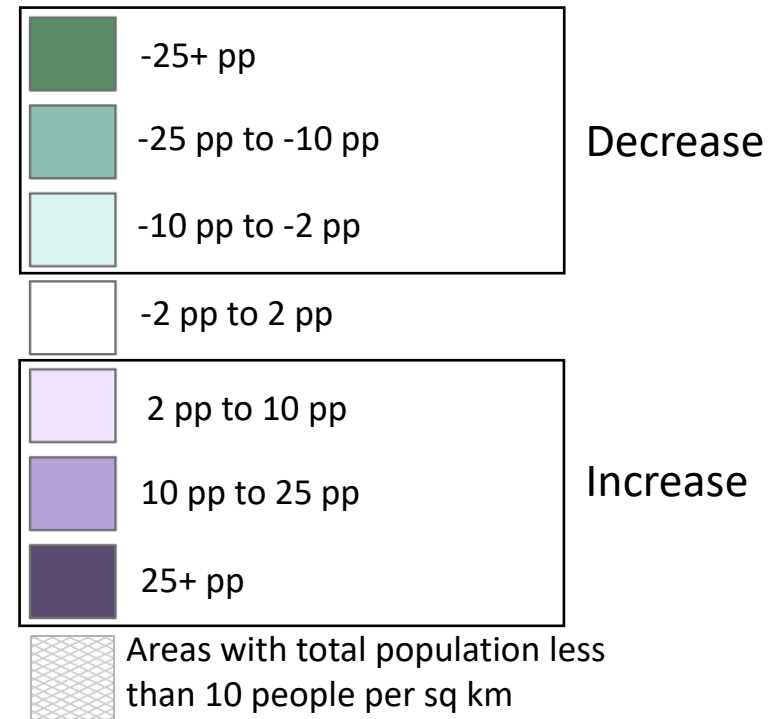
Change in the Prevalence of Under-15 Child Marriage: 2011 to 2016

Esri, HERE, Garmin, FAO, NOAA, USGS

National Under-15 Prevalence

2011	2016
13.6%	9.3%

Percentage Point (pp) Change in Under-15 Prevalence from 2011 to 2016

-25+ pp	Decrease
-25 pp to -10 pp	
-10 pp to -2 pp	
-2 pp to 2 pp	
2 pp to 10 pp	Increase
10 pp to 25 pp	
25+ pp	

Areas with total population less than 10 people per sq km

City Large cities

Note 1: Modeled estimates at the sq km level in 2005 for Saint Louis do not meet Fraym quality standards. As a result, estimates in this region should be considered as less precise and interpreted with caution. Statistics for departments in this region are not presented.
Source: Fraym, Senegal DHS (2016 and 2011)

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Broadly, regional rates of under-15 child marriage decreased on average between 2005 and 2016. Kédougou and Diourbel experienced the largest decreases, whereas Matam experienced an uptick in prevalence rates over the 11-year period.

Change in the Under-15 Child Marriage Prevalence Rate, by Region

Source: Fraym, Senegal DHS (2016, 2011, and 2005)
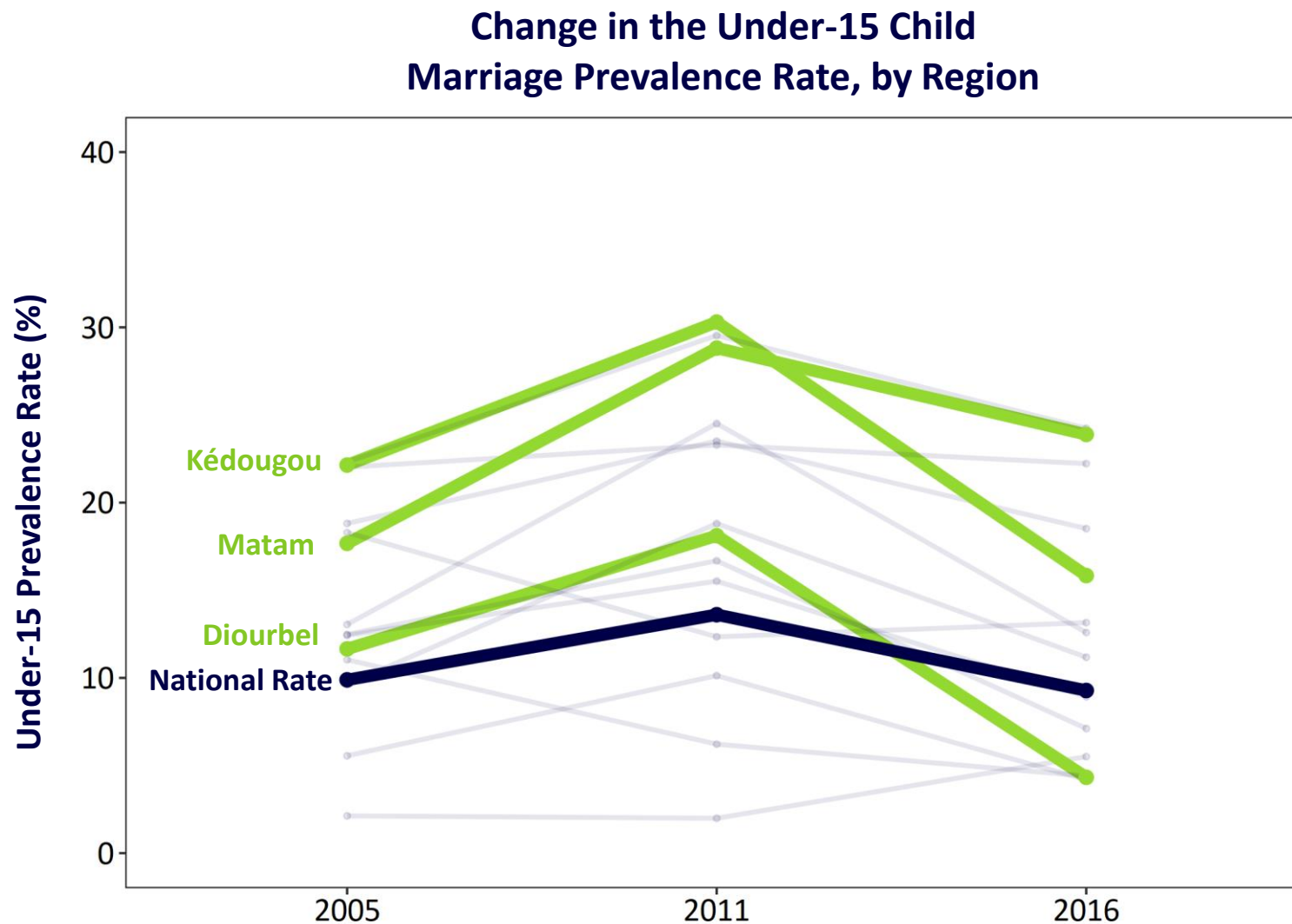
There were 17 departments with increases in under-15 prevalence between 2005 and 2016. Simultaneously, 28 departments achieved decreases, two of which were double digit increases.[1]

Largest Percentage Point Increase in Under-15 Prevalence (2005 to 2016)		Largest Percentage Point Decrease in Under-15 Prevalence (2005 to 2016)	
Matam (Matam)	+ 8 pp	Kédougou (Kédougou)	- 10 pp
Dakar (Dakar)	+ 8 pp	Goudomp (Sédhiou)	- 8 pp
Podor (Saint-Louis)	+ 5 pp	Mbacké (Diourbel)	- 7 pp
Koumpentoum (Tambacounda)	+ 4 pp	Fatick (Fatick)	- 7 pp
Ranérou Ferlo (Matam)	+ 4 pp	Foundiougne (Fatick)	- 6 pp
Salémata (Kédougou)	+ 4 pp	Gossas (Fatick)	- 6 pp
Kanel (Matam)	+ 4 pp	Sédhiou (Sédhiou)	- 6 pp
Tambacounda (Tambacounda)	+ 2 pp	Bambey (Diourbel)	- 5 pp

Note 1: Fraym calculated the percentage point (pp) difference between 2005 and 2016 to determine whether a county witnessed an increase or decrease in under-15 prevalence. In the tables above, the region is listed in parentheses.
Source: Fraym, Senegal DHS (2016, 2005)

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While both under-18 and under-15 prevalence rates decreased between 2005 and 2016, these improvements were relatively small.

1. From 2005 to 2016, the national under-18 prevalence rate fell from 39 percent to 35 percent. During this time, the number of women aged 20-24 who were married before 18 rose from 200,000 to 230,000 due to population growth.

2. Spatiotemporal analysis indicates that the decreases are most concentrated in the South and West, **with the largest decreases occurring between 2005 and 2011**. Departments during this time period saw decreases of four percentage points on average.

3. Nationally, the under-15 prevalence rate for women aged 20-24 fell from 10 percent in 2005 to 9 percent in 2016. Overall, the total number of women (aged 20-24) who were married before the age of 15 increased from 51,000 to 62,000 women because of population growth.

4. **Between 2005 and 2011, there was a slight uptick in under-15 child marriage rates across most communities in Senegal**. This trend reversed between 2011 and 2016 with departments experiencing drops of four percentage points on average.

5. The **Kédougou and Goudomp** departments experienced the largest decreases in under-15 prevalence and the **Bounkiling and Sédhiou** departments experienced the largest decreases in under-18 prevalence.

Community Characteristics

COMMUNITY CHARACTERISTICS || SECTION OVERVIEW

Fraym assessed a variety of indicators that help to illuminate community contexts and their relationship with child marriage prevalence.[1]

1 First, Fraym **developed a list of indicators based on feedback and discussion with child marriage experts**. Broadly, indicators capture socioeconomic characteristics and access to services.

2 More specifically, **target community-level indicators include traditionally child-marriage specific factors** (employment and education), and less explored factors, such as access to electricity or improved sanitation at home.

3 Fraym produced **hyperlocal maps of each indicator** in order to identify communities with high concentrations of these indicators.

4 Fraym also analyzed the **relationship between under-18 prevalence and each indicator at the department level.** The analysis assesses the relationship both visually as well as through the calculation of the correlation coefficient. [2]

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COMMUNITY CHARACTERISTICS || METHODOLOGICAL OVERVIEW

Fraym mapped a variety of community characteristics, then analyzed the statistical relationship with child marriage prevalence at the zone level.[1]

Socioeconomic Characteristics	
Adult Employment Adult Female Employment Educational Attainment by Sex	*Expected Relationship* = Areas with higher employment or educational attainment may have lower rates of child marriage prevalence.
Sexual and Reproductive Health	
Modern Contraceptive Prevalence	*Expected Relationship* = The relationship between contraceptive prevalence and child marriage is complicated given the close relationship between adolescent childbearing and child marriage.[2]
Health and Nutrition	
Child Stunting Health System Usage	*Expected Relationship* = Child stunting may be higher due to early childbearing associated with child marriage; areas with higher usage of the health system may have lower rates of child marriage prevalence.
Infrastructure	
Access to Electricity Access to Improved Sanitation	*Expected Relationship* = Areas with better infrastructure may have lower rates of child marriage prevalence.

Note 1: Analyses are bivariate and thus do not control for other factors. Please see slides 29-37 and the appendix for indicator definitions.
**Note 2:** Increasing evidence suggests that many married adolescent girls report not using contraception due to a desire to become mothers. For example, see https://reproductive-health-journal.biomedcentral.com/articles/10.1186/s12978-019-0686-9
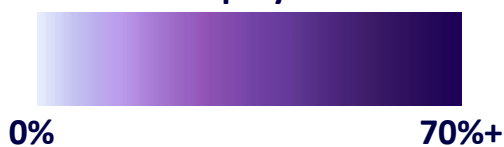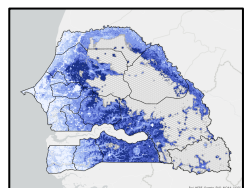
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COMMUNITY CHARACTERISTICS || ADULT EMPLOYMENT

There is no clear relationship between under-18 prevalence and adult employment, as evidenced by the correlation coefficient. High prevalence departments have both high and low employment rates.

Adult Employment at the Community Level
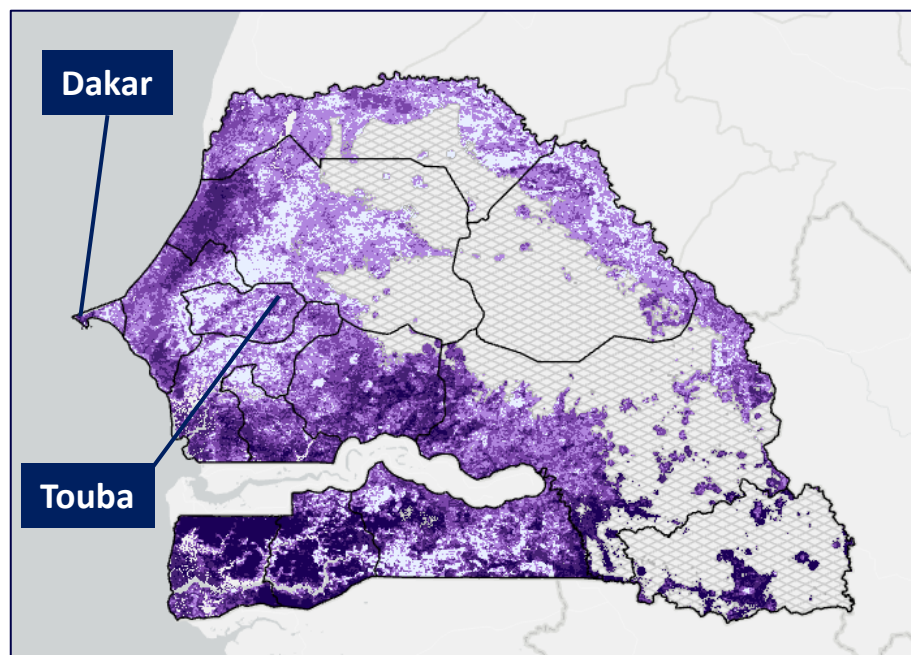
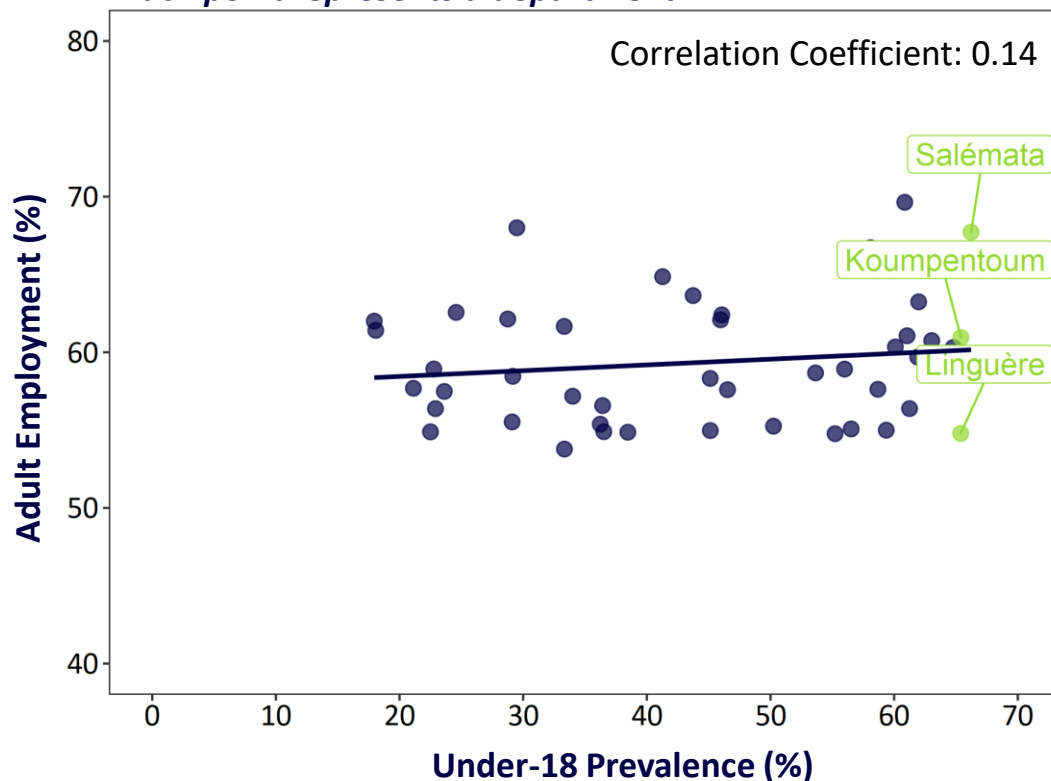Percent of adults (aged 15-49) that are employed

0%   70%+

Under 18 Prevalence

| City | Large cities |

Areas with total population less than 10 people per sq km

Adult Employment Rate and Child Marriage Prevalence

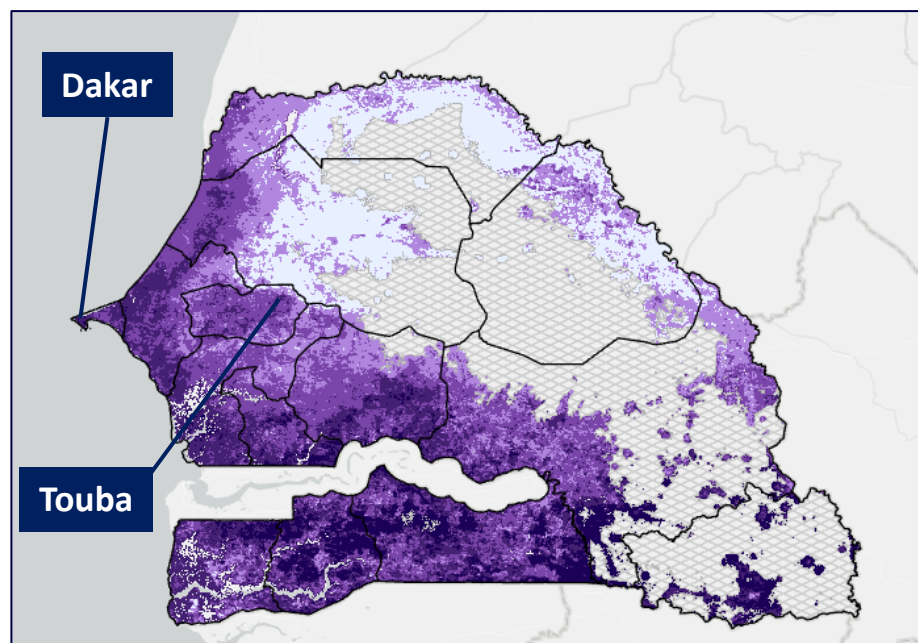*Each point represents a department.*

Correlation Coefficient: 0.14

Salémata
Koumpentoum
Linguère

The y-axis intervals vary across indicators depending on the range of the values.

Similar to overall employment, there is not a clear relationship between child marriage prevalence and female employment.

Adult Female Employment at the Community Level
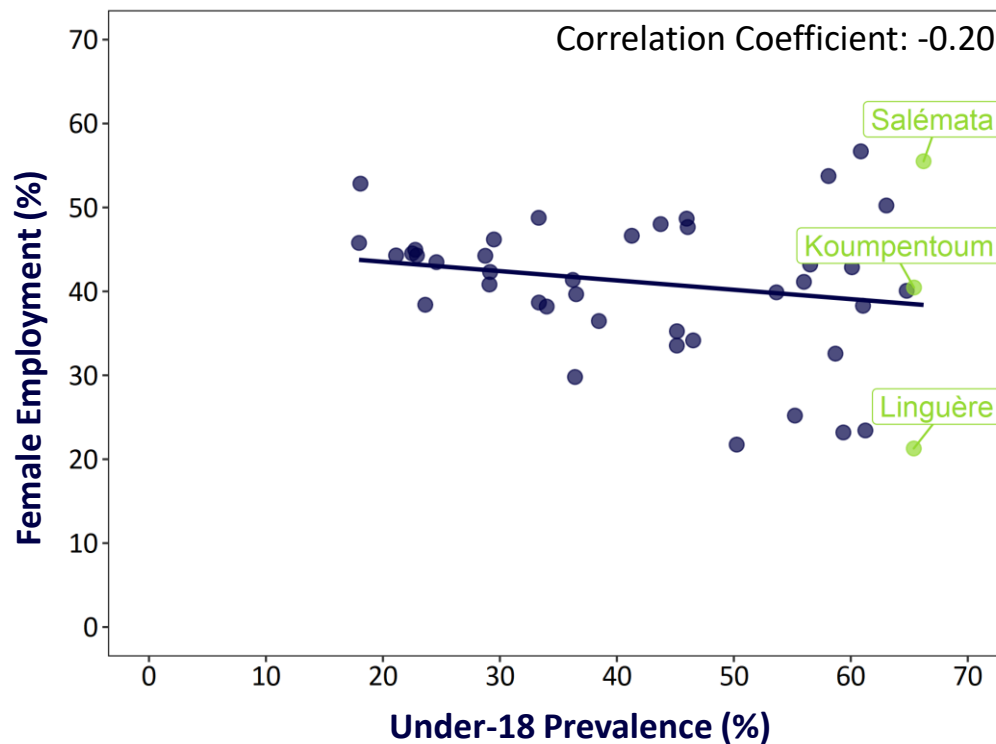

Percent of women (aged 15-49) that are employed
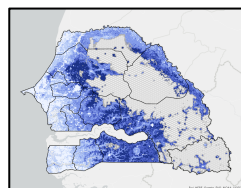
0%   50%+

Under 18 Prevalence | **City** Large cities | Areas with total population less than 10 people per sq km

Adult Female Employment Rate and Child Marriage Prevalence
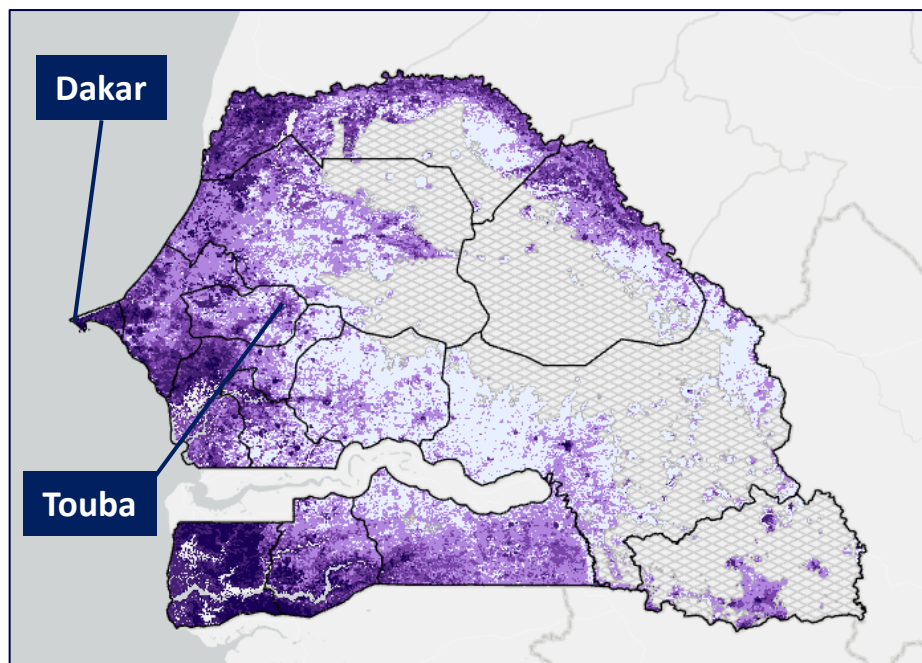
Each point represents a department.

Correlation Coefficient: -0.20

Salémata

Koumpentoum

Linguère

Female Employment (%)

Under-18 Prevalence (%)

The y-axis intervals vary across indicators depending on the range of the values.

Departments with high prevalence rates tend to have lower rates of female educational attainment. The correlation coefficient indicates a strong relationship.

Female Educational Attainment at the Community Level

Dakar

Touba

Percent of women (aged 18-49) who completed primary school or higher
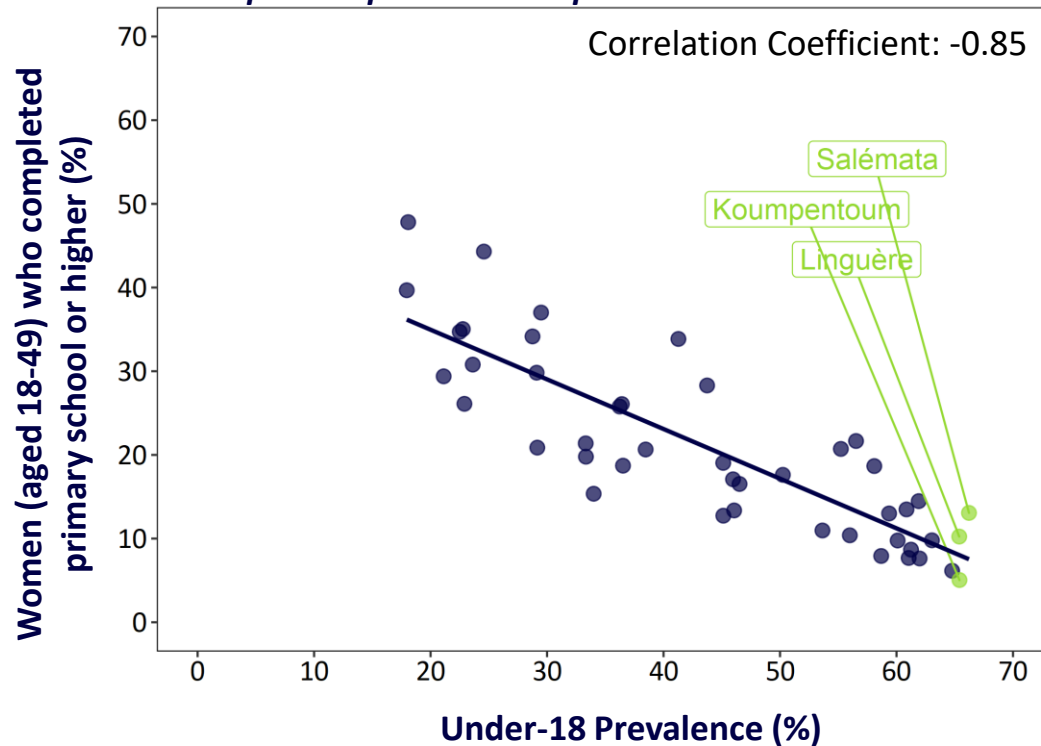
Under 18 Prevalence

0%   40%+
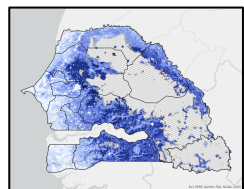
City Large cities

Areas with total population less than 10 people per sq km

Female Education Attainment and Child Marriage Prevalence
Each point represents a department.

Correlation Coefficient: -0.85

Women (aged 18-49) who completed primary school or higher (%)

Under-18 Prevalence (%)

Salémata

Koumpentoum

Linguère

The y-axis intervals vary across indicators depending on the range of the values.

Source: Fraym, Senegal DHS 2016

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Departments with high prevalence tend to have low rates of male educational attainment. This relationship, captured by the correlation coefficient, is strong.

Male Educational Attainment at the Community Level
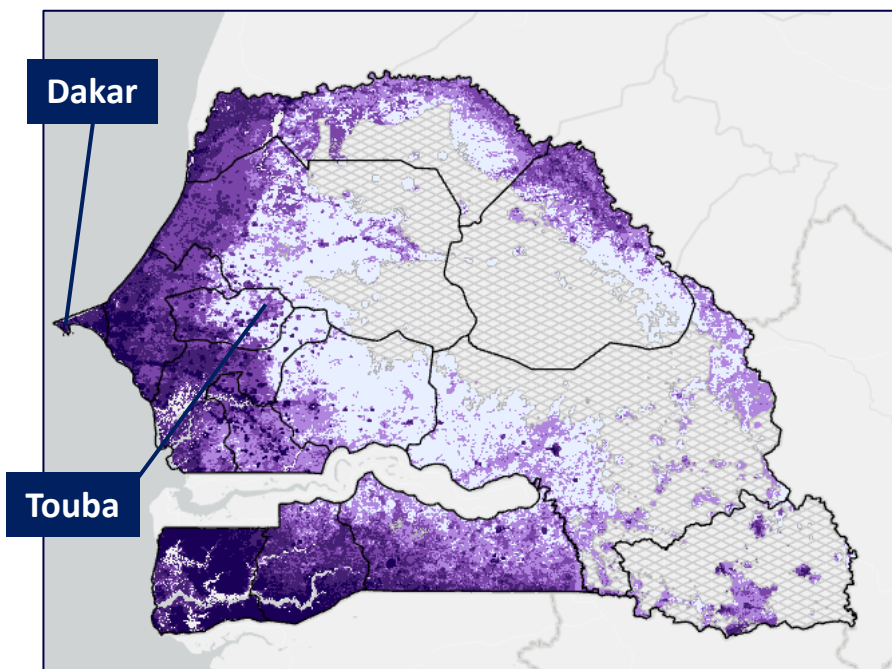
Percent of men (aged 18-49) who completed primary school or higher
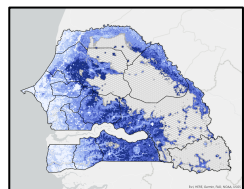
0%   50%+

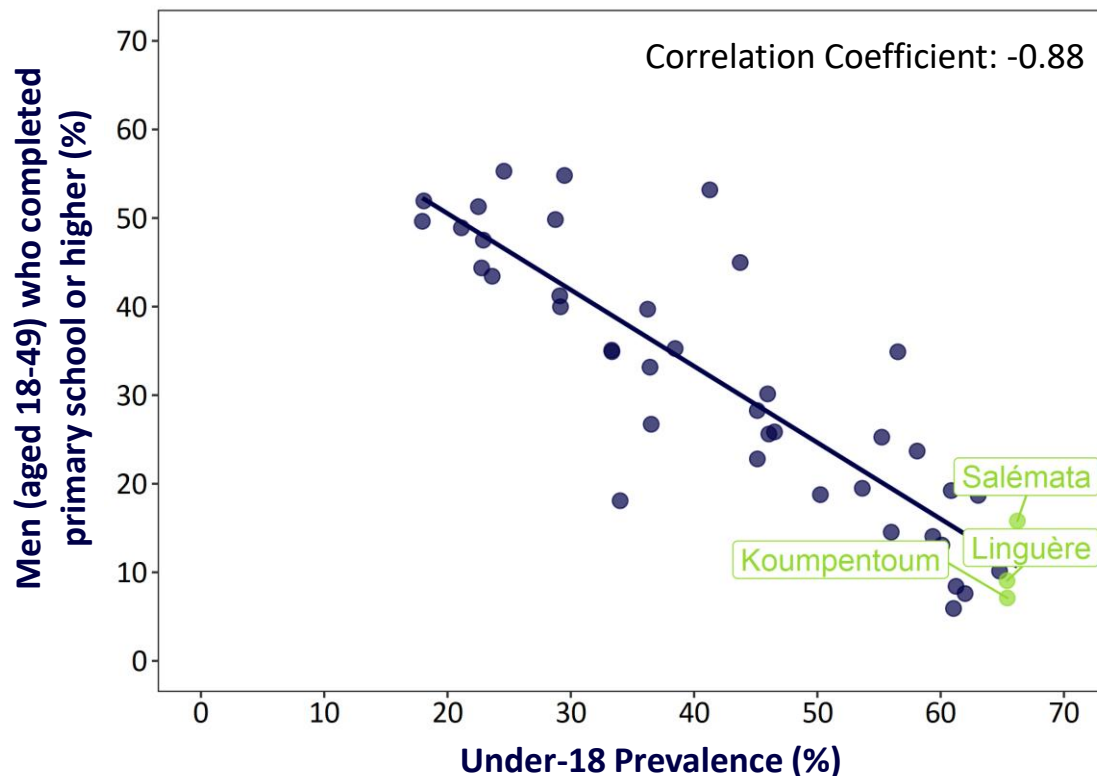*Under 18 Prevalence*   **City** Large cities   Areas with total population less than 10 people per sq km

Male Education Attainment and Child Marriage Prevalence

Each point represents a department.

Correlation Coefficient: -0.88

Men (aged 18-49) who completed primary school or higher (%)

Under-18 Prevalence (%)

Salémata
Koumpentoum
Linguère

The y-axis intervals vary across indicators depending on the range of the values.

Source: Fraym, Senegal DHS 2016

Departments with high child marriage prevalence tend to have lower rates of modern contraceptive use.[1]

Modern Contraceptive Use at the Community Level

Percent of women (aged 15-24) who are sexually active and use a modern contraceptive method

0%   25%+
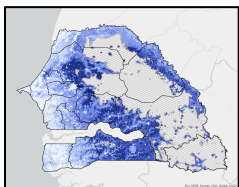
Under 18 Prevalence

City Large cities

Areas with total population less than 10 people per sq km

Modern Contraceptive Use and Child Marriage Prevalence
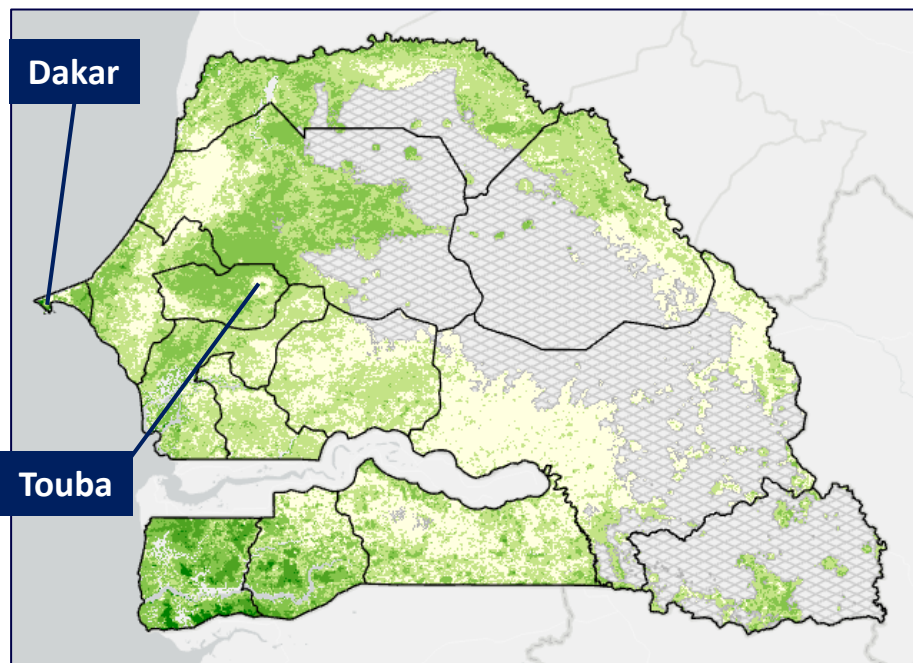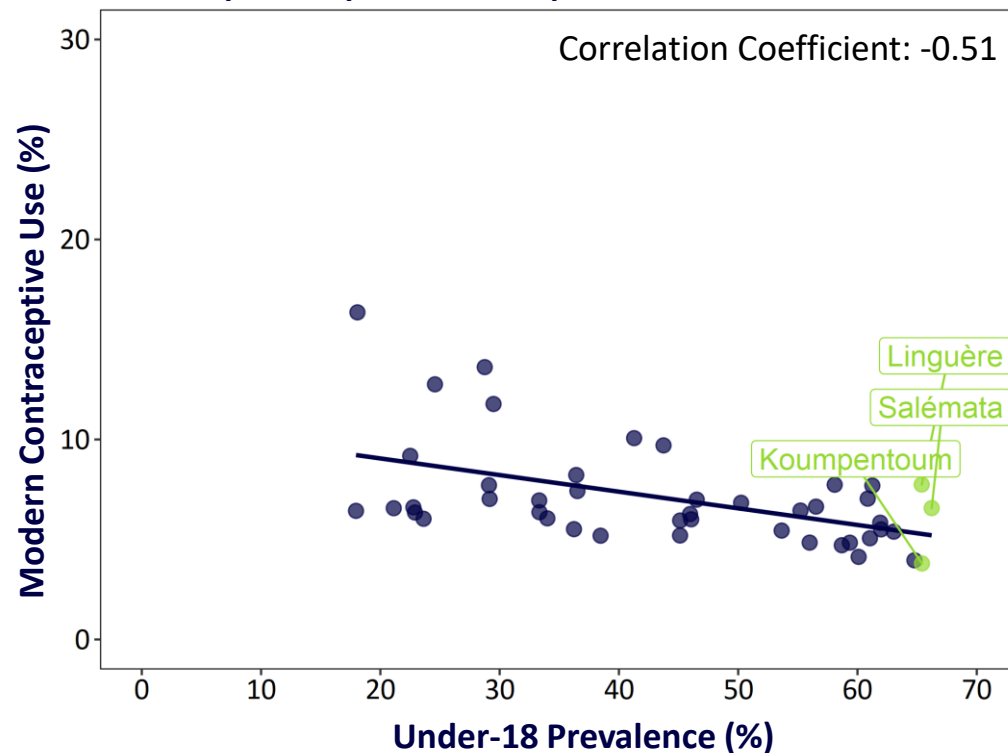*Each point represents a department.*

Correlation Coefficient: -0.51

Linguère
Salémata
Koumpentoum

*The y-axis intervals vary across indicators depending on the range of the values.*

Note 1: Modern contraceptive prevalence is defined using the DHS definition, that is the percent of women (aged 15-49) that use a modern method. Modern methods exclude periodic abstinence and withdrawal, which are considered traditional methods.
Source: Fraym, Senegal DHS 2016

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There is a strong negative correlation between child marriage prevalence and health system usage.[1]

Health System Usage at the Community Level
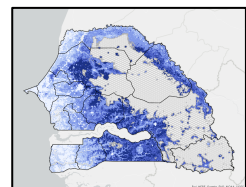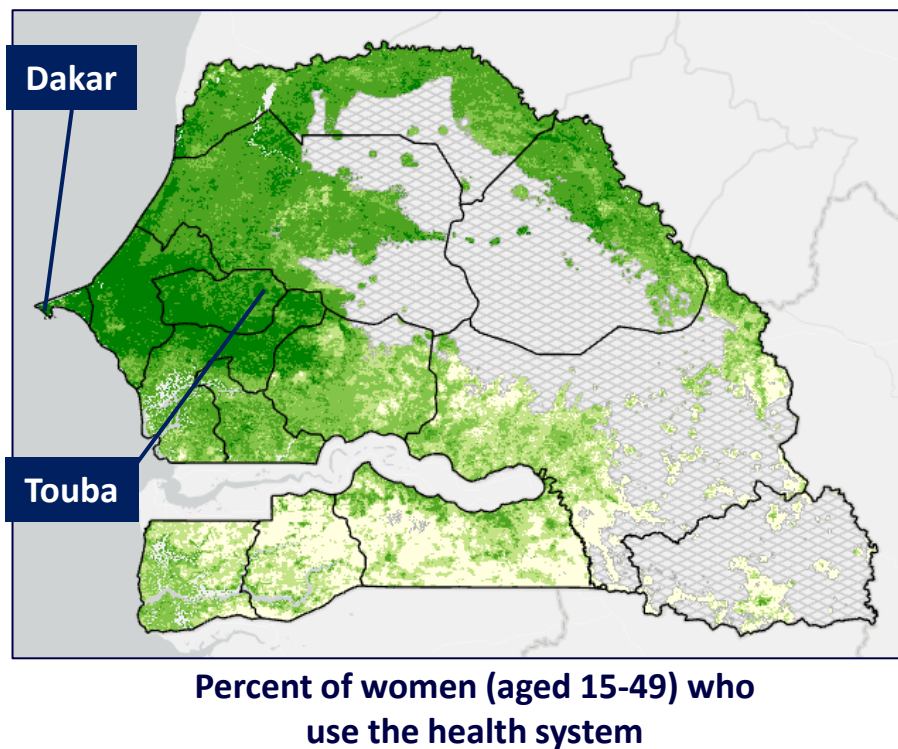
Percent of women (aged 15-49) who use the health system

0%　　　　　　　　60%+

Under 18 Prevalence

City Large cities

Areas with total population less than 10 people per sq km

Health System Usage and Child Marriage Prevalence

Each point represents a department.

Correlation Coefficient: -0.63

Linguère
Koumpentoum
Salémata

Percent of women (aged 15-49) who use the health system

Under-18 Prevalence (%)

The y-axis intervals vary across indicators depending on the range of the values.
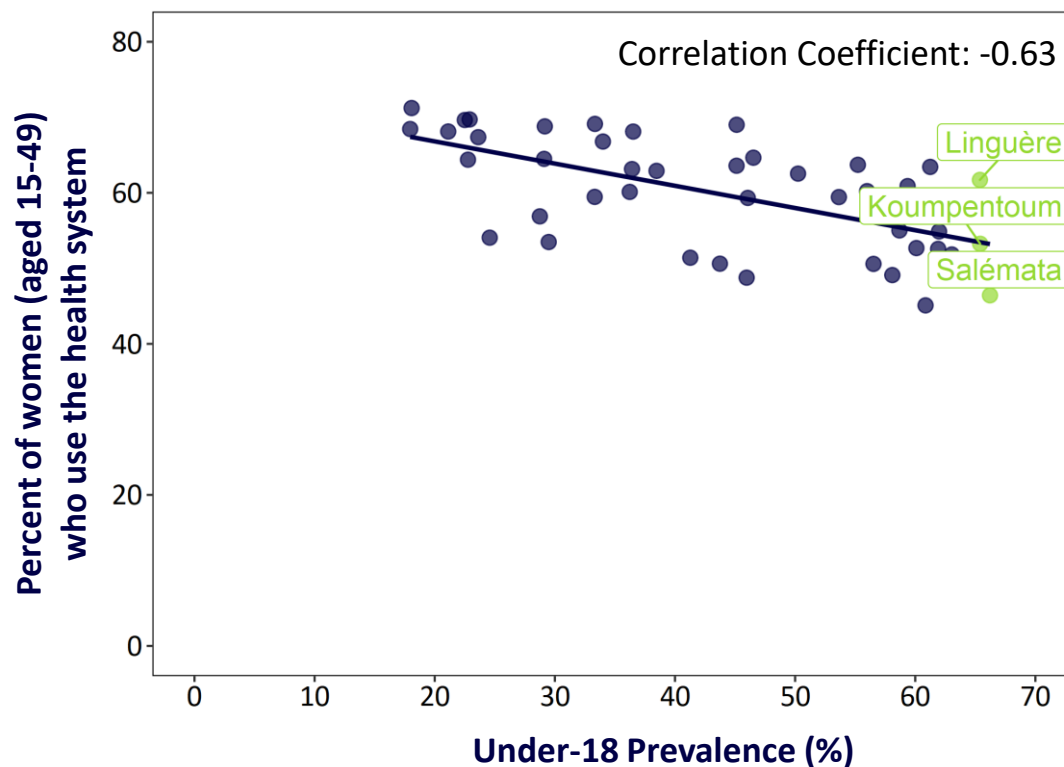
Note 1: Health system usage is defined as women (ages 15-49) who have visited a health facility or have been visited by a fieldworker to talk about family planning in the past 12 months.
Source: Fraym, Senegal DHS 2016

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Departments with high prevalence tend to also have high rates of child stunting. This relationship is strong, as evidenced by the correlation coefficient.

Child Stunting at the Community Level
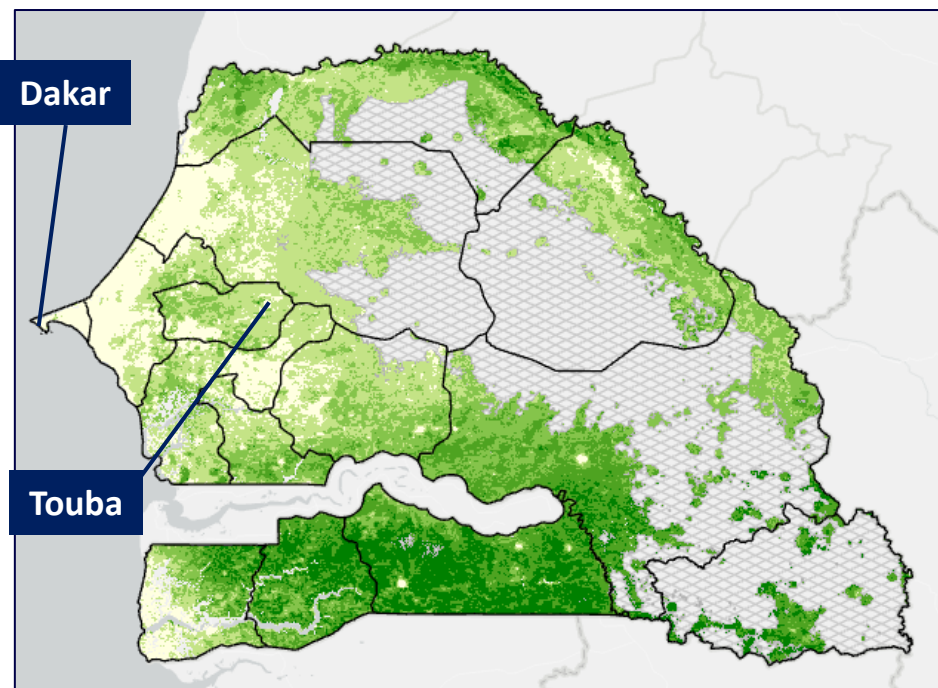
Percent of children under five who are stunted
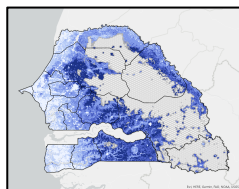
0%   30%+

Under 18 Prevalence

City — Large cities

Areas with total population less than 10 people per sq km

Child Stunting and Child Marriage Prevalence
Each point represents a department.

Correlation Coefficient: 0.76

Salémata
Linguère
Koumpentoum

Child Stunting (%)

Under-18 Prevalence (%)

The y-axis intervals vary across indicators depending on the range of the values.

Source: Fraym, Senegal DHS 2016

Departments with high under-18 prevalence tend to have low rates of access to electricity. The magnitude of the correlation coefficient indicates a strong relationship.

Access to Electricity at the Community Level

Percent of individuals that live in households with access to electricity

0%   70%+

Dakar
Touba
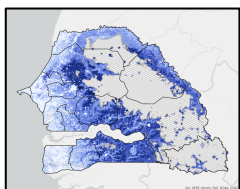
Under 18 Prevalence

City Large cities

Areas with total population less than 10 people per sq km

Access to Electricity and Child Marriage Prevalence
Each dot represents a department.

Correlation Coefficient: -0.86

Linguère
Salémata
Koumpentoum

Access to Electricity (%)

Under-18 Prevalence (%)

The y-axis intervals vary across indicators depending on the range of the values.

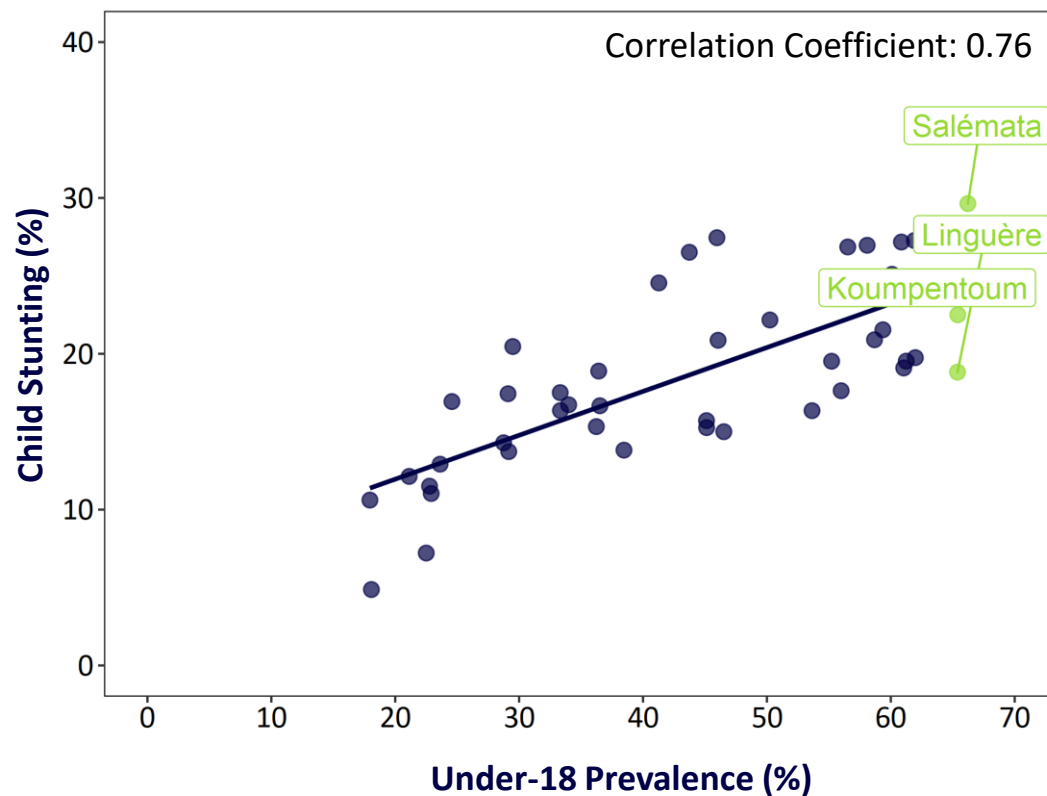Departments with high child marriage prevalence have low rates of access to a flush toilet.

Flush Toilet Access at the Community Level

Percent of individuals that live in households with a flush toilet

0%   20%+
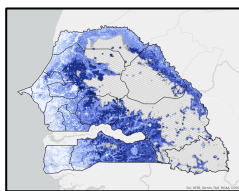
Under 18 Prevalence

City — Large cities

Areas with total population less than 10 people per sq km

Flush Toilet Access and Child Marriage Prevalence
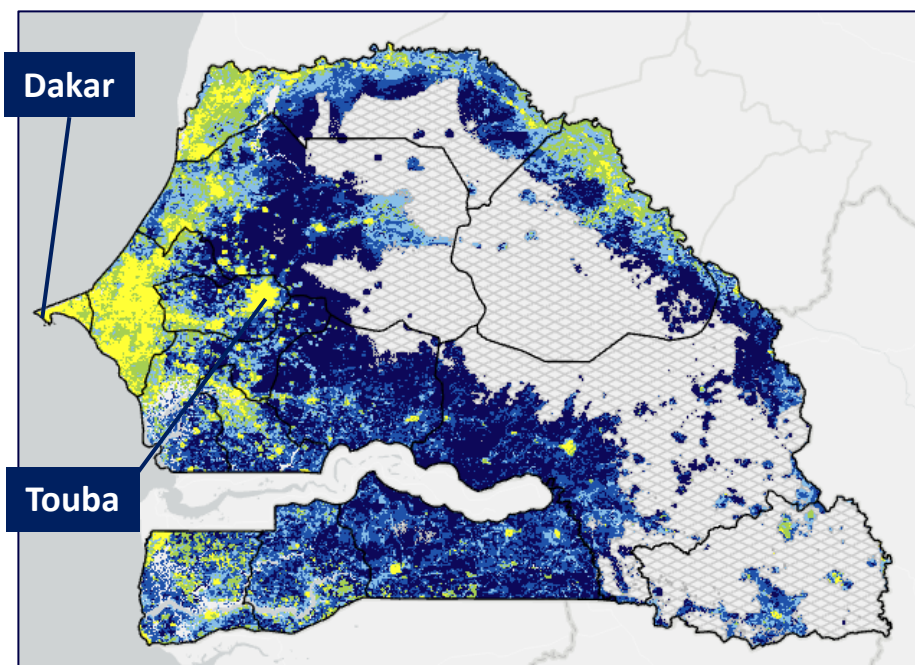
Each dot represents a department.

Correlation Coefficient: -0.79

Linguère
Salémata
Koumpentoum

Access to a flush toilet (%)

Under-18 Prevalence (%)
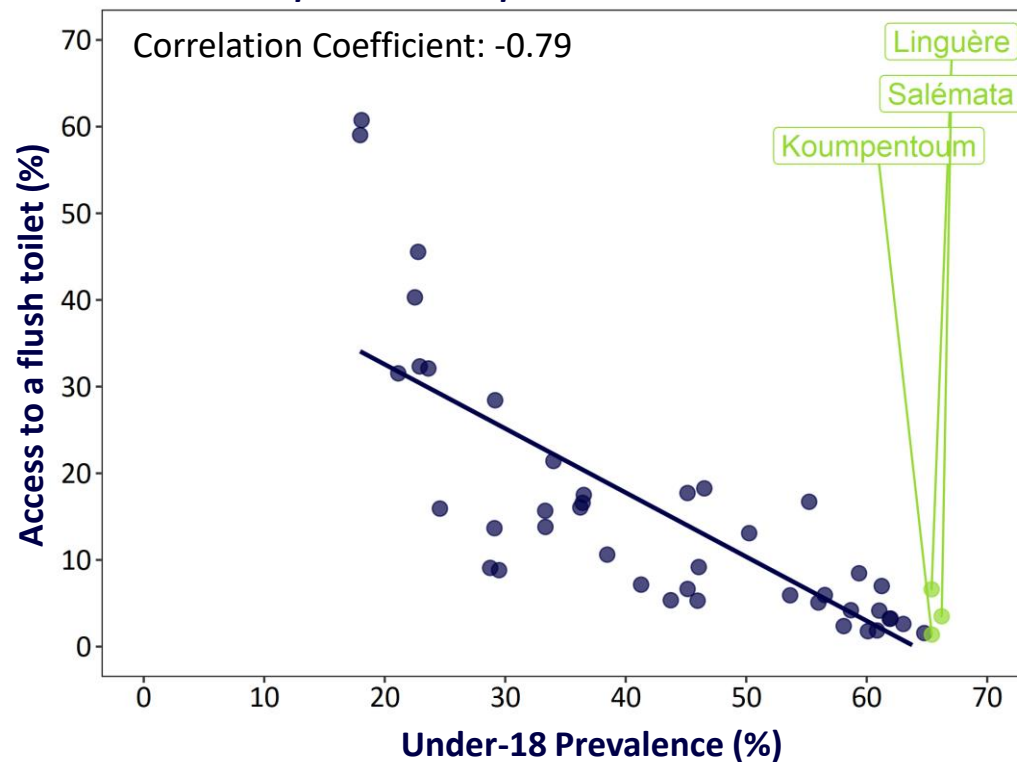
The y-axis intervals vary across indicators depending on the range of the values.

COMMUNITY CHARACTERISTICS || KEY TAKEAWAYS
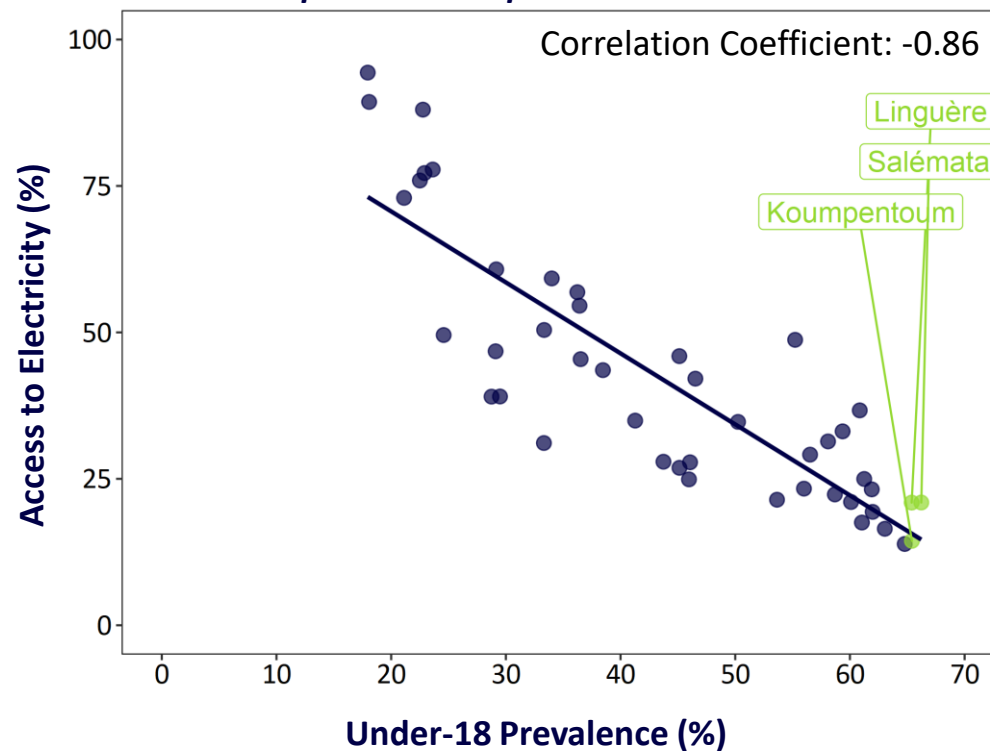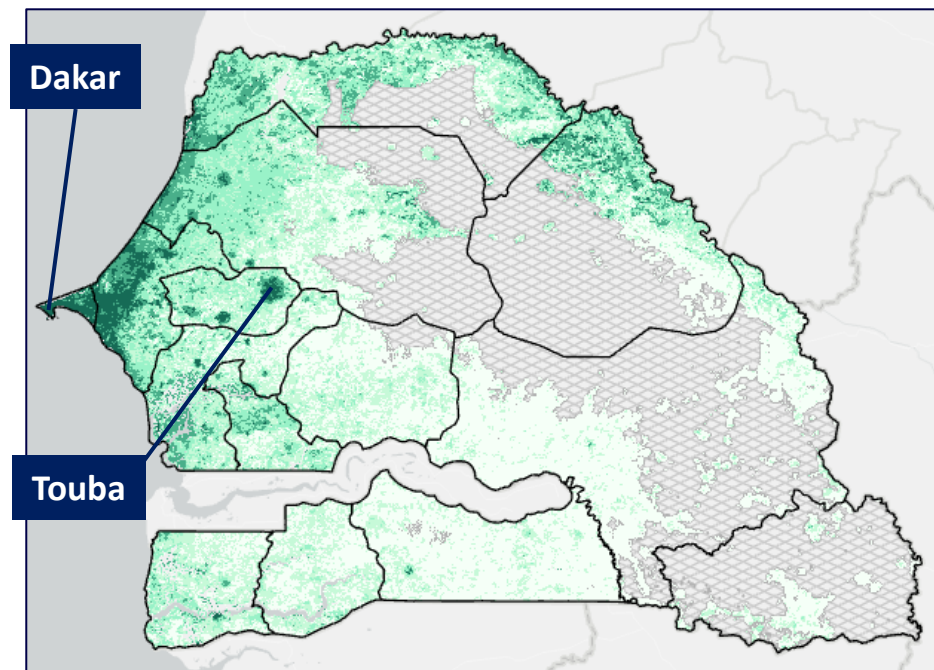
The direction and magnitude of the correlation coefficient between various community indicators and child marriage is largely as expected.

1 Both **male and female education are the indicators most strongly associated with under-18 child marriage**. The direction of the relationship is negative.

2 The correlation coefficient between employment and child marriage prevalence is the smallest magnitude across the examined characteristics, which may indicate that the type of employment matters.

3 Even indicators that are **not traditionally considered in the child marriage literature, such as access to electricity or flush toilets, have a strong negative relationship** with child marriage prevalence.

Correlation Coefficient with Child Marriage Prevalence at the Zone Level	
Socioeconomic Characteristics	
Adult Employment	0.14
Female Employment	-0.20
Female Educational Attainment	-0.85
Male Educational Attainment	-0.88
Health	
Modern Contraceptive Use	-0.51
Health System Usage	-0.63
Child Stunting	0.76
Infrastructure	
Access to Electricity	-0.86
Access to Improved Sanitation	-0.79

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At-Risk Population

AT-RISK POPULATION || SECTION OVERVIEW

Fraym segmented the population at risk of child marriage based on three potential risk factors: (i) pregnancy outside of marriage; (ii) poverty; and (iii) gender-equitable attitudes and behaviors.

1. Based on a summary of the literature and expert consultation, Fraym **examined relevant indicators to identify the presence of three potential risk factors** of child marriage in Senegal.

2. Fraym then **estimated the potential risk factor profiles at the community level (1 km^2) and categorized communities** as low-, medium-low, medium-high, or high risk based upon the national distribution (e.g., quartiles).

3. Next, Fraym **estimated the at-risk population of girls aged 10 to 14 by isolating the high-risk areas** across each of the three risk profiles and calculating the total number of girls aged 10 to 14 that live in those communities.

4. Finally, Fraym looked at the relationship between child marriage prevalence and risk factor profiles to better **assess whether high-risk areas are also high prevalence areas**.

5. Identifying areas where young girls are at risk of child marriage can help decision-makers better target program, policy, and advocacy efforts.

Literature suggests that pregnancy among young women and child marriage are linked, although it is difficult to disentangle the directionality.

1 Pregnancy among young women in Senegal is relatively high – 31 percent of women aged 15 to 24 have given birth, regardless of marital status.

2 Birth without marriage is very uncommon in Senegal. Only three percent of never-married women aged 15 to 24 have given birth. This low proportion suggests that most births occur within marriage.

3 To assess the relationship between pregnancy and child marriage, Fraym isolated pregnancy occurring outside of marriage by focusing on ever-married women who gave birth either anytime before marriage or up until six months after marriage. This framing assumes that the woman knew that she was pregnant prior to marriage and may have decided to get married as a result of the pregnancy.

Women who have given birth, by age group and marital status (%)			
	Aged 20-24	Aged 15-19	Aged 15-24
All women	52%	13%	31%
Ever-married women[1]	77%	48%	67%
Never-married women[2]	8%	1%	3%

Note 1: Ever-married women include women who are currently married, living with a partner, widowed, divorced, or are no longer living together. Fraym also looked at currently married women only and found the proportions across age groups to be similar to ever-married women.
Note 2: Proportions of never-married women who gave birth in the 20-24 age range and 15-19 age range are excluded due to sample size.
Source: Fraym, Senegal DHS 2016

Among women who were married as children, eight percent gave birth either before or within six months of marriage. This figure suggests pregnancy outside of marriage is an unlikely risk factor for child marriage in Senegal.

(1) Only eight percent of ever-married women aged 15-24 have given birth outside of marriage. In fact, the average interval between marriage and first birth among this cohort is 20 months.[1] Together, these figures suggest that pregnancy outside of marriage may be uncommon.

(2) If pregnancy outside of marriage was a strong risk factor for child marriage, we would expect a high proportion of women married before age 18 to have given birth outside of marriage. However, only eight percent of women aged 20-24 who were married before age 18 gave birth before or within six months of marriage.

Women who have given birth before or within six months of marriage, by age group and marital status (%)			
	Aged 20-24	Aged 15-19	Aged 15-24
All women[2]	6%	1%	3%
Ever-married women[2]	9%	<1%	8%
Women who were married before age 18	8%	—	—

Note 1: The average interval between marriage and first birth excludes women who gave birth before marriage. The DHS does not report the number of months for negative intervals.
Note 2: Ever-married women include women who are currently married, living with a partner, widowed, divorced, or are no longer living together. Fraym also looked at currently married women only and found the proportions across age groups to be similar to ever-married women.
Source: Fraym, Senegal DHS 2016

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AT-RISK POPULATION || POVERTY AND CHILD MARRIAGE (ANALYTIC FRAMEWORK)

Literature suggests a strong relationship between poverty and child marriage. To measure poverty, Fraym focuses on education, employment, and overall wealth.[1]

1 **Education:** A large majority of household heads with daughters have primary schooling or less (88 percent) .

2 **Employment:** Most household heads with daughters are employed, and less than half of those employed work in unskilled manual labor or are self-employed in agriculture.[2] Among women aged 15-24, about a quarter are employed, and of those employed, a 31 percent work in unskilled manual labor or are self-employed in agriculture.

Poverty-related Indicators	
Education	
Household heads with daughters, and who have primary schooling or less	88%
Employment	
Household heads with daughters, and who are currently employed	85%
Employed household heads with daughters, and who are working in unskilled manual labor or self-employed in agriculture	42%
Women (aged 15-24) who are employed	26%
Employed women (aged 15-24) working in unskilled manual labor or self-employed in agriculture	31%

Note 1: Risk profile indicators, particularly wealth, are explained in more detail in the appendix.
Note 2: Based on expert consultations, Fraym identified employment in agriculture or unskilled manual labor as low opportunity jobs, or jobs that are likely to have low pay and/or poor working conditions.
**Source:** Fraym, Senegal DHS 2016

AT-RISK POPULATION || POVERTY AND CHILD MARRIAGE (NATIONAL CONTEXT)

In Senegal, employed women aged 20-24 who married before 18 were almost twice as likely to work in unskilled manual labor or self-employment in agriculture compared to all employed women in the same age range. Additionally, women married as children tend to be less wealthy.

Employment indicators for women aged 20-24

Indicator	Women (aged 20-24)	Women (aged 20-24) who were married before age 18
Women who are employed	30%	31%
Employed women working in unskilled manual labor or self-employed in agriculture[2]	27%	50%

Distribution of women aged 20-24 by wealth quintile and under-18 prevalence[1]

Married Before 18
■ No
■ Yes

Percent of Women Aged 20-24

Wealth Quintile
(Lowest to Highest)
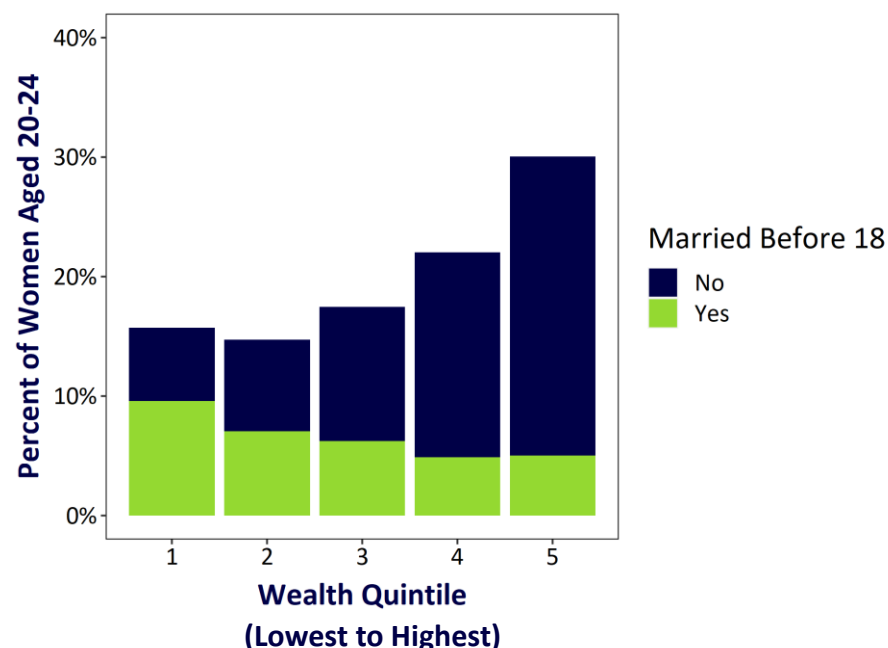
Note 1: The wealth index is a standard DHS variable. It is a composite measure of a household's cumulative living standard, calculated using information on household asset ownership, housing materials, and access to water and sanitation services. The first quintile is the poorest while the fifth quintile is the wealthiest.

Note 2: Based on expert consultations, Fraym identified employment in agriculture or unskilled manual labor as low opportunity jobs, or jobs that are likely to have low pay and/or poor working conditions.

Source: Fraym, Senegal DHS 2016

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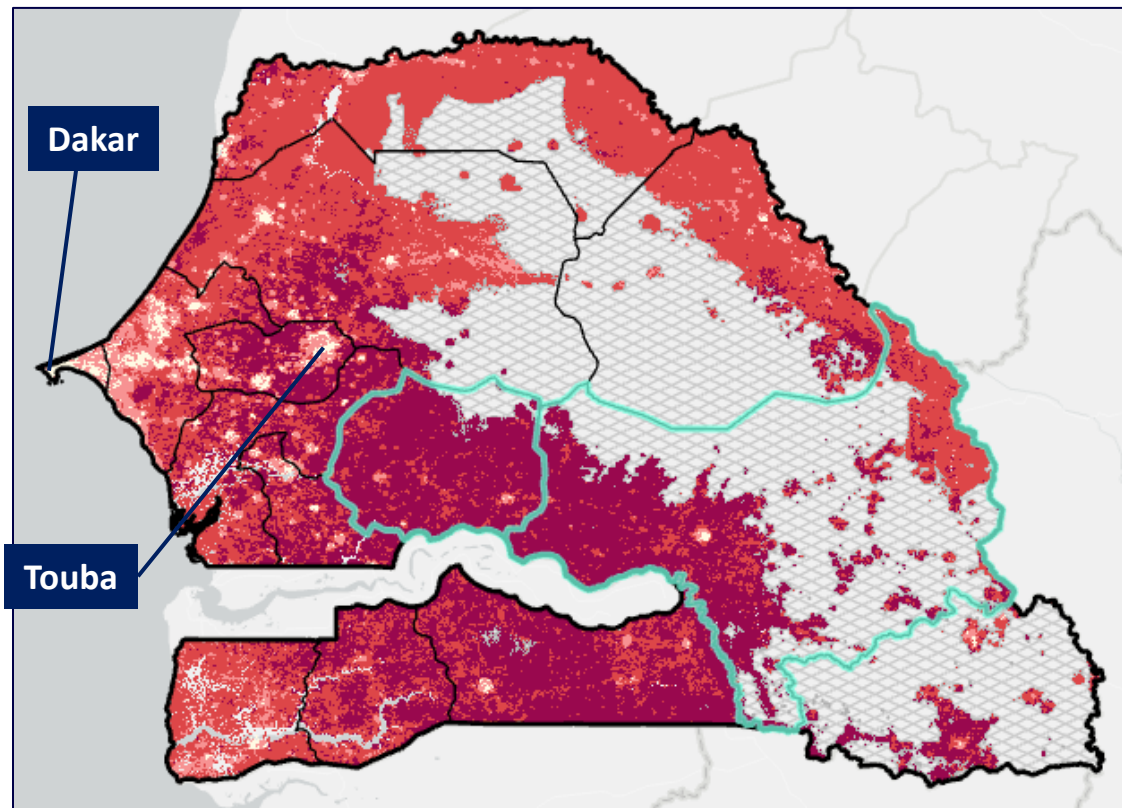# AT-RISK POPULATION || POVERTY & CHILD MARRIAGE (RISK PROFILE CONSTRUCTION)

The poverty risk profile reflects a given community's wealth, employment and education levels, which are calculated using principal component analysis.

1   Based on feedback and analysis, Fraym **selected four indicators to capture poverty**: (i) wealth; (ii) employment in unskilled manual labor or self-employment in agriculture for women aged 15 to 24; (iii) educational attainment of the household head; and (iv) employment of the household head in unskilled manual labor or self-employment in agriculture for the household head.

2   Fraym **combined the indicators into a poverty risk profile index using principal component analysis (PCA)** and estimated the risk scores at the community level (1 km^2).

3   Fraym then **classified communities into quartiles with risk categories ranging from 1 to 4.** Communities with higher index values, or more impoverished as defined by the index, are categorized as a 4 ("high risk").

4   Finally, Fraym **estimated the number of at-risk girls** by calculating the total number of girls aged 10 to 14 who live in the communities where poverty represents the highest risk for child marriage (categorized as a 4).

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There are an estimated 225,000 girls aged 10 to 14, or roughly 25 percent, who live in communities where poverty represents a high risk for child marriage.

Poverty Index Risk Category[1]

Low Risk	
Medium-Low Risk	
Medium-High Risk	
High Risk	
Areas with total population less than 10 people per sq km	
City Large cities	

Population of at-risk girls due to poverty, highlighted regions[2]

Region	Population of at-risk girls (aged 10-14)
Kaffrine	35,500
Tambacounda	32,000

Note 1: The map shows the classification of the poverty index for each 1km² cell into quartiles. The poverty index risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. See slide 43 or the appendix for more details.
Note 2: At-risk girls are defined as girls at risk for child marriage, that is girls aged 10-14 who live in communities with a poverty index risk category equal to 4 (highest risk).
Source: Fraym, Senegal DHS 2016, WorldPop 2020

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AT-RISK POPULATION || POVERTY & CHILD MARRIAGE (RISK PROFILE MAPPING)

Communities with high under-18 child marriage prevalence also have high rates of poverty or are classified as high risk for child marriage due to poverty.

Child Marriage Prevalence

Dakar

Touba

Percent of women (aged 20-24) who were married before 18

0%   65%+

Areas with total population less than 10 people per sq km

City Large cities

Poverty Index Risk Category[1]

Dakar

Touba

Low Risk

Medium-Low Risk

Medium-High Risk

High Risk

Note 1: The map shows the classification of the poverty index for each 1km² cell into quartiles. The poverty index risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. See slide 43 or the appendix for more details..
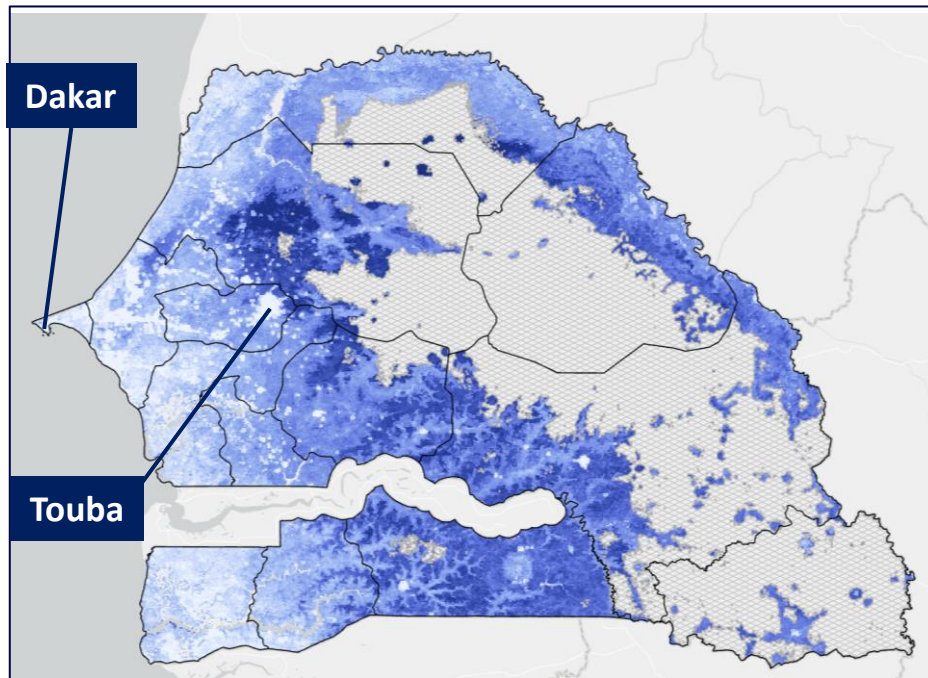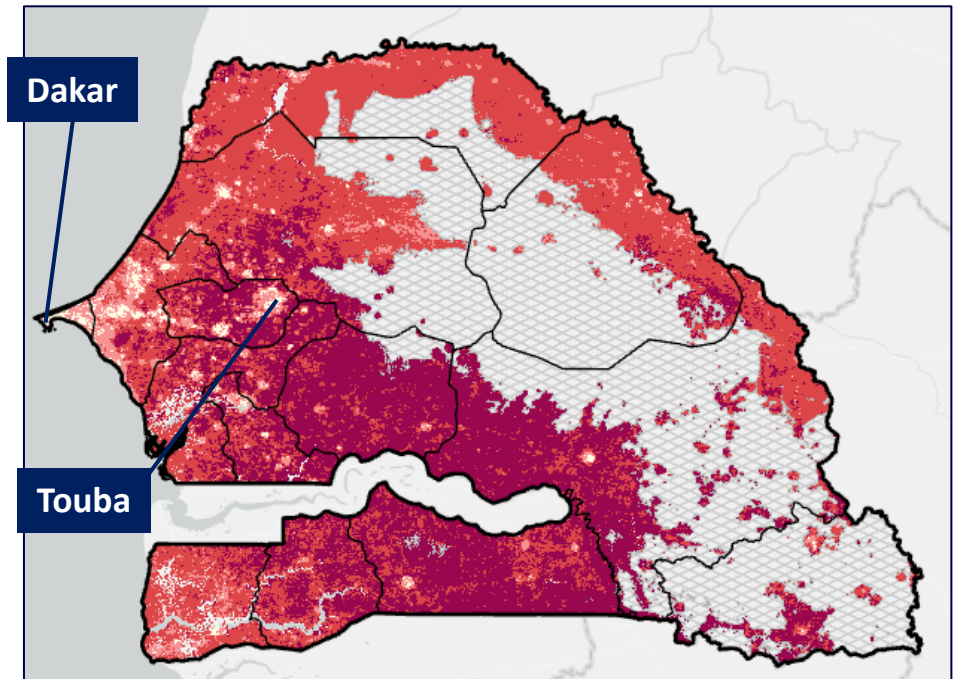**Source:** Fraym, Senegal DHS 2016, WorldPop 2020

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AT-RISK POPULATION || POVERTY & CHILD MARRIAGE (RISK PROFILE MAPPING)

Departments with high child marriage prevalence tend to be classified as higher risk for child marriage due to poverty. The correlation coefficient indicates a strong relationship, meaning poverty is a likely risk factor for child marriage in Senegal.

Average Poverty Index Risk Category and Child Marriage Prevalence

Each dot represents a department.

Correlation Coefficient: 0.82

Under-18 Prevalence (%)
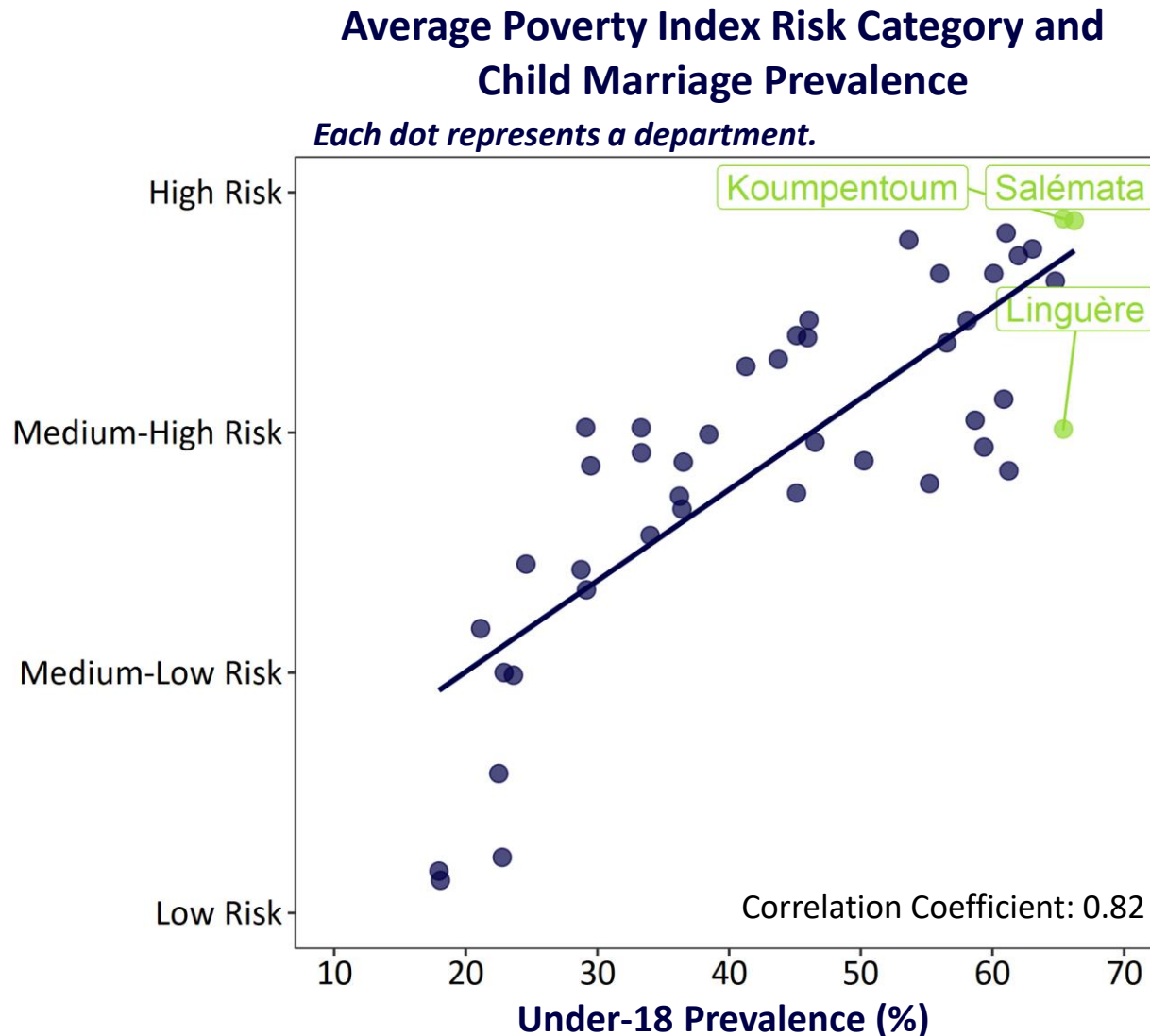
AT-RISK POPULATION || ATTITUDES, BEHAVIORS & CHILD MARRIAGE (NATIONAL CONTEXT)

Gender-equitable attitudes and behaviors may be associated with lower rates of child marriage.

1. To measure gender-equitable attitudes and behaviors, Fraym used attitudes towards domestic violence and women's participation in decision-making.

2. Attitudes towards domestic violence may be related to child marriage. Roughly one out of every eight men and nearly one out of every six women (aged 15-49) believe that there are situations wherein wife beating is justified.

3. Women's greater participation in decision making may imply empowerment, and thus may be related to lower rates of child marriage. In Senegal, an exceptionally large proportion of currently married women do not participate in any household decisions.

Attitudes and behaviors, by sex		
	Women	Men
Domestic Violence		
Believe that there is at least one reason that justifies wife beating	16%	13%
Women's Participation in Decision Making[1]		
Respondent's healthcare	16%	-
Large household purchases	15%	-
Visits to family	11%	-
Husband's earnings	15%	-
No decisions	70%	

Note 1: Women's participation in decision-making is defined as the woman reporting that she makes the decision on her own or jointly with her partner. Questions regarding decision making are only asked to currently married individuals. Currently married men were asked about decision making on their own healthcare and major household purchases, however these figures are excluded.
Source: Fraym, Senegal DHS 2016

Communities where individuals agree that wife-beating is justified are more likely to have high child marriage prevalence rates.

(1) Fraym examined the correlation between attitudes towards wife beating and child marriage prevalence at the community level.

(2) Fraym then estimates the selected indicator at the community level (1 km^2) and classified communities into quartiles with risk categories ranging from 1 to 4. Communities with higher rates of affirming attitudes towards wife beating are categorized as a 4 ("high risk").

(3) Finally, Fraym estimated the number of at-risk girls by calculating the total number of girls aged 10 to 14 who live in the communities where gender inequitable attitudes represents the highest risk for child marriage (categorized as a 4).

Indicator	Description	Correlation Coefficient with under-18 child marriage prevalence[1]
Domestic Violence		
Believe that there is at least one reason that justifies wife beating[2]	Proportion of women/men (aged 15-49) who agree with at least one reason that a husband is justified in hitting or beating his wife	0.73

Note 1: The correlation coefficient indicates the direction and magnitude of the relationship at the community (enumeration area) level.
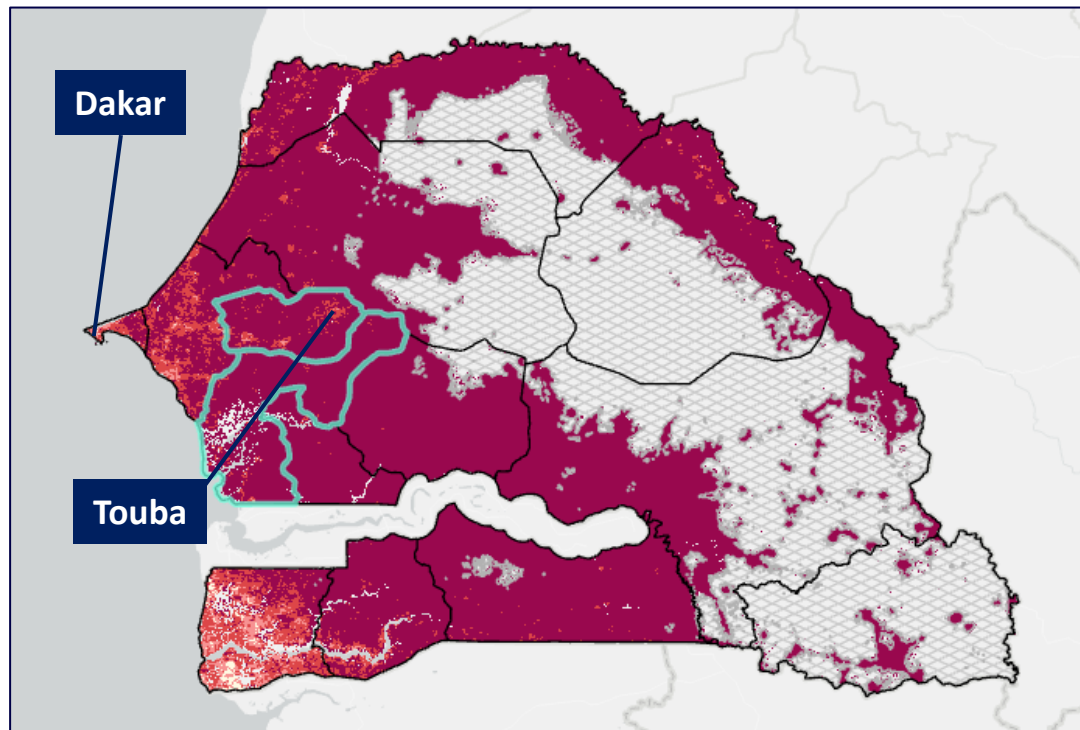**Note 2:** Please see the appendix for details of the specific reasons asked by the DHS.
Source: Fraym, Senegal DHS 2016

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AT-RISK POPULATION || ATTITUDES & CHILD MARRIAGE (RISK PROFILE MAPPING)

There are an estimated 655,000 girls aged 10 to 14 who live in communities where gender inequitable attitudes represents a high risk for child marriage. Roughly two-thirds of all girls aged 10 to 14 are at-risk.

Attitudes towards Wife Beating Risk Category[1]

Legend:
- Low Risk
- Medium-Low Risk
- Medium-High Risk
- High Risk
- Areas with total population less than 10 people per sq km
- City — Large cities

Population of at-risk girls due to attitudes towards wife beating, highlighted regions[2]

Region	Population of at-risk girls (aged 10-14)
Diourbel	80,500
Fatick	72,000

Note 1: The map shows the classification of attitudes towards wife beating for each 1km² cell into quartiles. The attitudes towards wife beating risk categories range from a 1 to 4 scale, with 4 indicating the highest level of risk. Attitudes towards wife beating is defined as belief that there is at least one reason that justifies wife beating. Please see slide 48 or the appendix for more details.
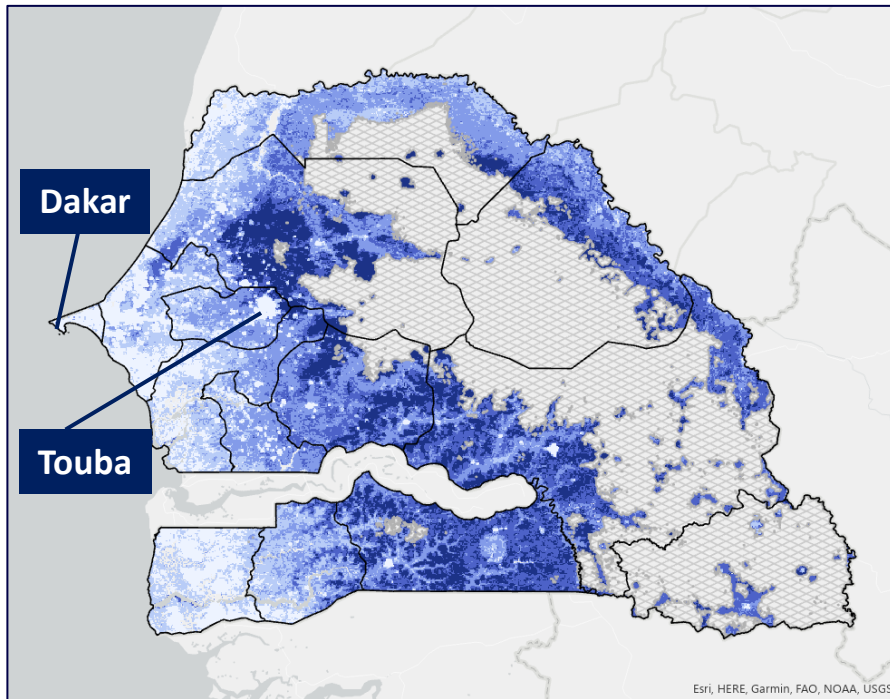
Note 2: At-risk girls are defined as girls at risk for child marriage, that is girls aged 10-14 who live in communities with an attitudes towards wife beating risk category equal to 4 (highest risk).

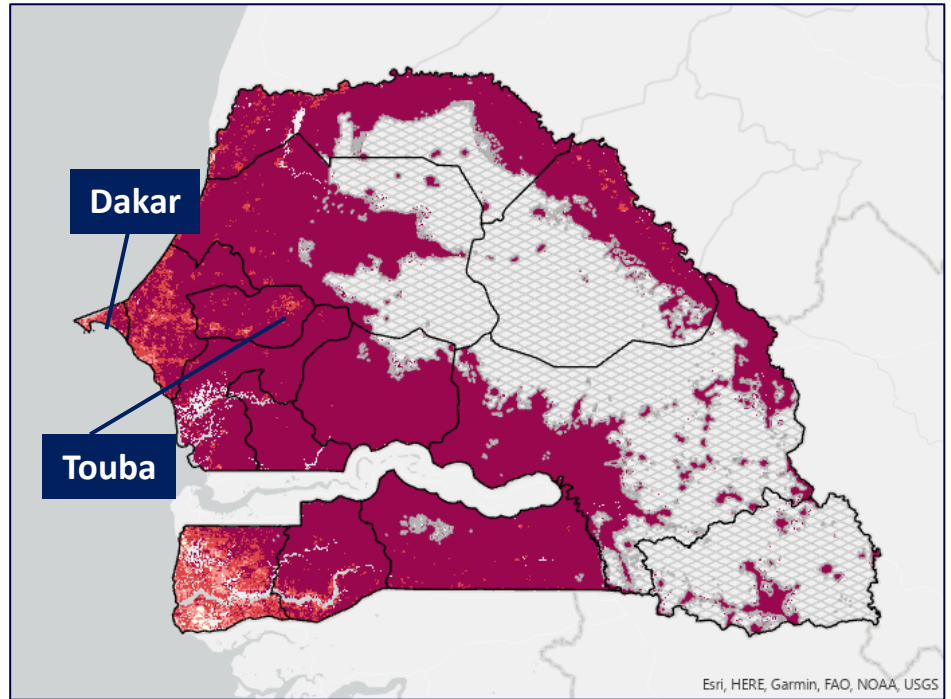**Source:** Fraym, Senegal DHS 2016, WorldPop 2020

AT-RISK POPULATION || ATTITUDES & CHILD MARRIAGE (RISK PROFILE MAPPING)

Communities where gender inequitable attitudes represents a high risk for child marriage are widespread, including in high prevalence areas.

Child Marriage Prevalence

Attitudes towards Wife Beating Risk Category[1]

Dakar

Touba

Esri, HERE, Garmin, FAO, NOAA, USGS

Percent of women (aged 20-24) who were married before 18

0%   65%+

Areas with total population less than 10 people per sq km
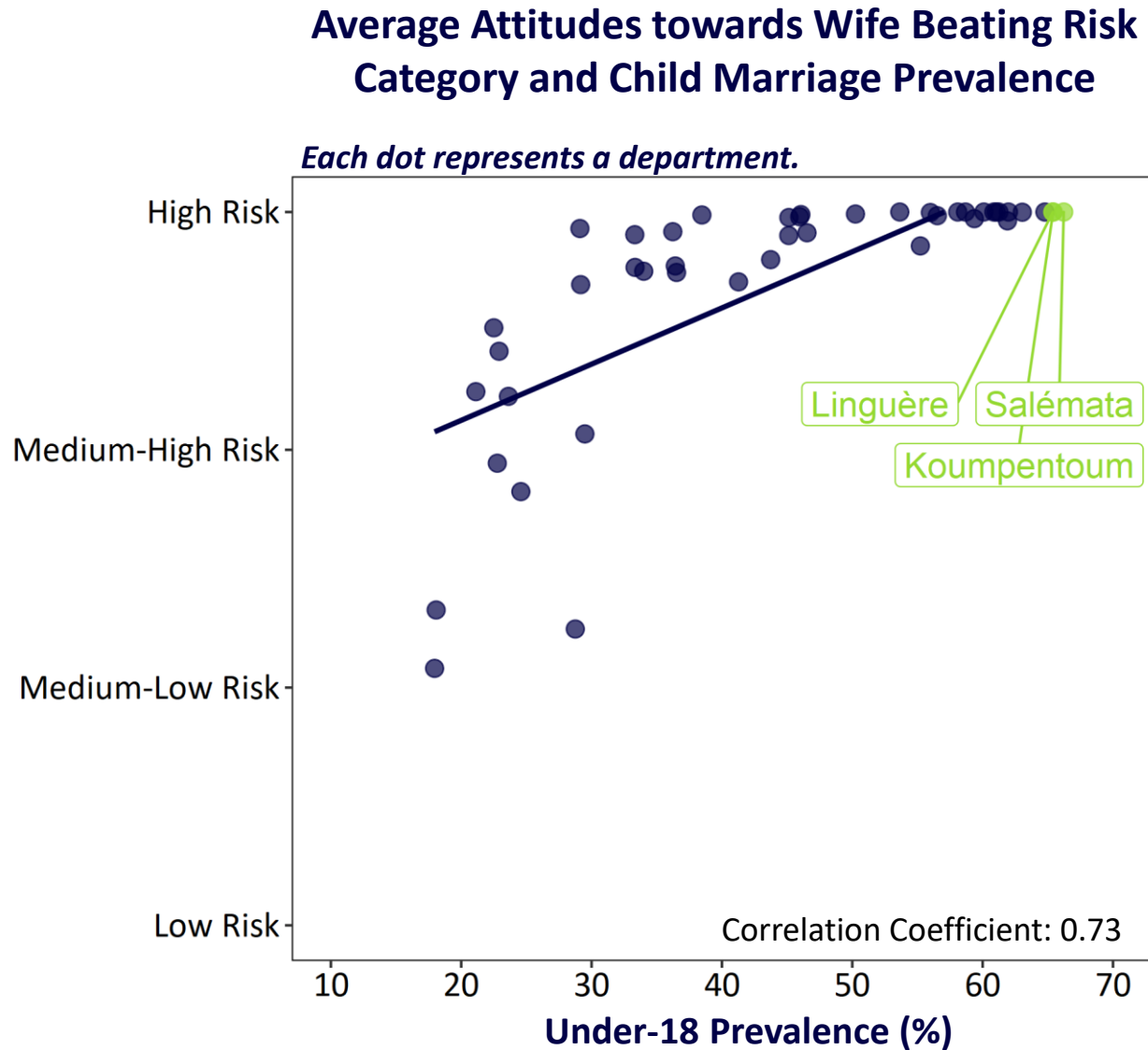
City   Large cities

Low Risk

Medium-Low Risk

Medium-High Risk

High Risk

Note 1: The map shows the classification of attitudes towards wife beating for each 1km² cell into quartiles. The attitudes towards wife beating risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Attitudes towards wife beating is defined as belief that there is at least one reason that justifies wife beating. Please see slide 48 or the appendix for more details.
Source: Fraym, Senegal DHS 2016, WorldPop 2020

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Departments with high child marriage prevalence tend to be classified as high risk for child marriage due to gender inequitable attitudes.

Average Attitudes towards Wife Beating Risk Category and Child Marriage Prevalence

Each dot represents a department.

Correlation Coefficient: 0.73

Linguère   Salémata   Koumpentoum

Under-18 Prevalence (%)

Source: Fraym

Communities where women are more likely to participate in decision-making tend to have lower child marriage prevalence.

(1) Fraym examined the correlation between women's participation in decision-making and child marriage prevalence at the community level.

(2) Communities with high prevalence rates tend to have low rates of women's participation in decision-making. The relationship between prevalence and decisions on large household purchases is strongest.

Indicator	Description	Correlation Coefficient with under-18 child marriage prevalence
Women's Participation in Decision Making[1]		
Respondent's healthcare	Proportion of currently married women (aged 15-49) who make the decision about their healthcare alone or jointly with partner	-0.20
Large household purchases	Proportion of currently married women (aged 15-49) who make the decision about large household purchases alone or jointly with partner	-0.27
Visits to family	Proportion of currently married women (aged 15-49) who make the decision about visits to family alone or jointly with partner	-0.19
Husband's earnings	Proportion of currently married women (aged 15-49) who make the decision husband's earnings alone or jointly with partner	-0.16

Note 1: Women's participation in decision-making is defined as the women making the decision on her own or jointly with her partner. Questions regarding decision making are only asked to currently married individuals. Currently married men were asked about decision making on their own healthcare and major household purchases, however these figures are excluded.
Source: Fraym, Senegal DHS 2016

AT-RISK POPULATION || BEHAVIORS & CHILD MARRIAGE (RISK PROFILE CONSTRUCTION)
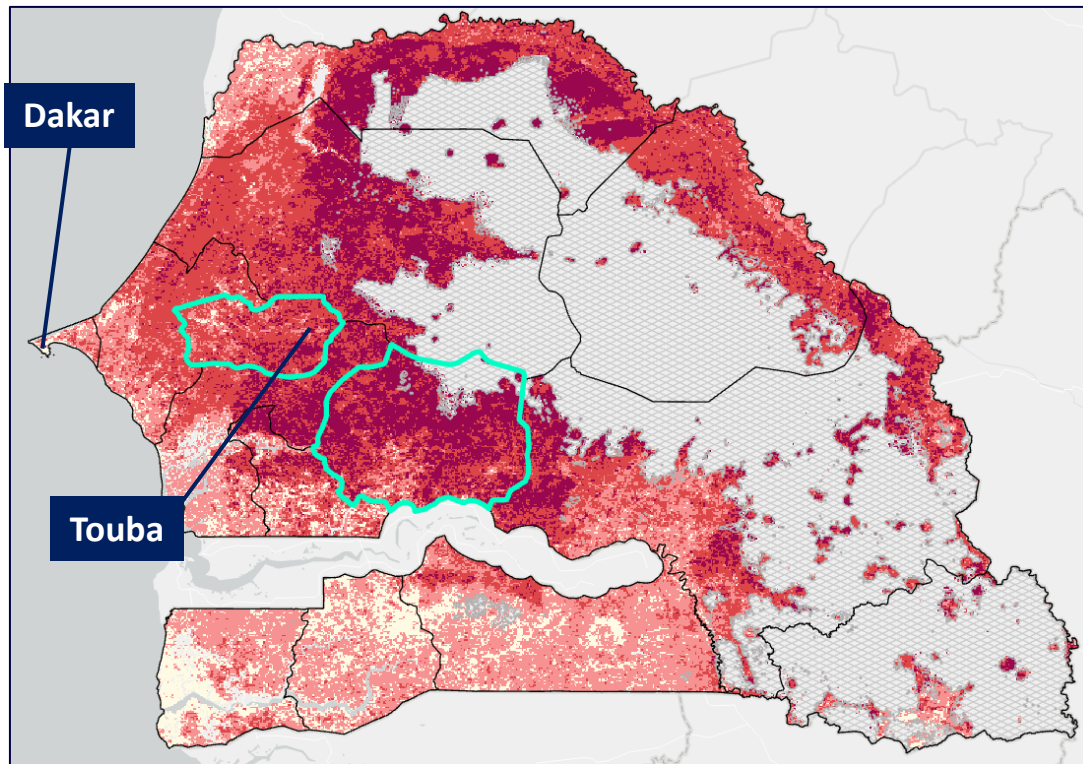
The decision-making risk profile captures the lack of women's participation in several major household decisions.

1 Fraym used **four indicators to assess women's participation in decision making in the household, decisions on**: (i) woman's health care; (ii) large household purchases; (iii) visits to family; (iv) husband's earnings.

2 Due to poor PCA results, Fraym modified the approach to the decision-making profile as compared to other countries that Fraym analyzed.

3 Fraym defined women's participation in decision-making as the **proportion of currently married women (aged 15-49) who report that they do not participate in any of these four major household decisions.**

4 Fraym **estimated the selected indicator at the community level and classified communities into quartiles with risk categories ranging from 1 to 4**. Communities with higher rates of women not participating in decision-making are categorized as a 4 ("high risk").

5 Finally, Fraym **estimated the number of at-risk girls** by calculating the total number of girls aged 10 to 14 who live in the communities where women's limited participation in household decision-making represents the highest risk for child marriage (categorized as 4) .

AT-RISK POPULATION || BEHAVIORS & CHILD MARRIAGE (RISK PROFILE MAPPING)

There are an estimated 130,000 girls aged 10 to 14 who live in communities where women's participation in decision-making represents a high-risk. Nearly 60 percent live in Kaffrine and Diourbel.

Women's Participation in Decision-Making Index Risk Category[1]

Legend:
- Low Risk
- Medium-Low Risk
- Medium-High Risk
- High Risk
- Areas with total population less than 10 people per sq km
- **City** Large cities

Population of at-risk girls due to women's lack of participation in decision-making, highlighted regions[2]

Region	Population of at-risk girls (aged 10-14)
Kaffrine	22,000
Diourbel	20,900

Note 1: The map shows the classification of currently married women aged 15 to 49 who do not participate in any household decisions for each 1km² cell into quartiles. The risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Please see slide 53 or the appendix for more details.
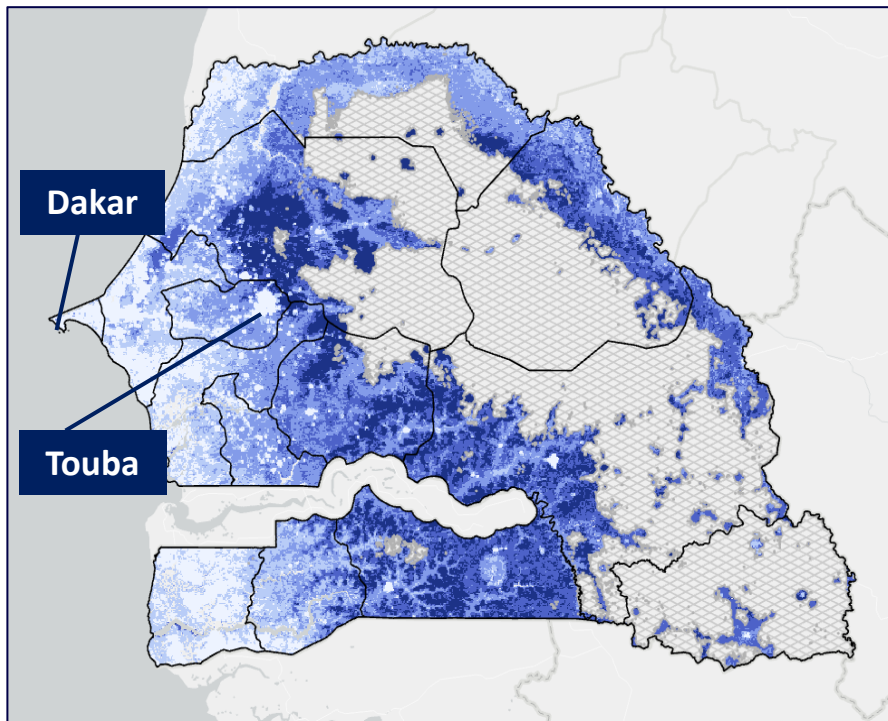**Note 2:** At-risk girls are defined as girls aged 10-14 who live in communities with a women's participation in decision-making risk category equal to 4 (highest risk).
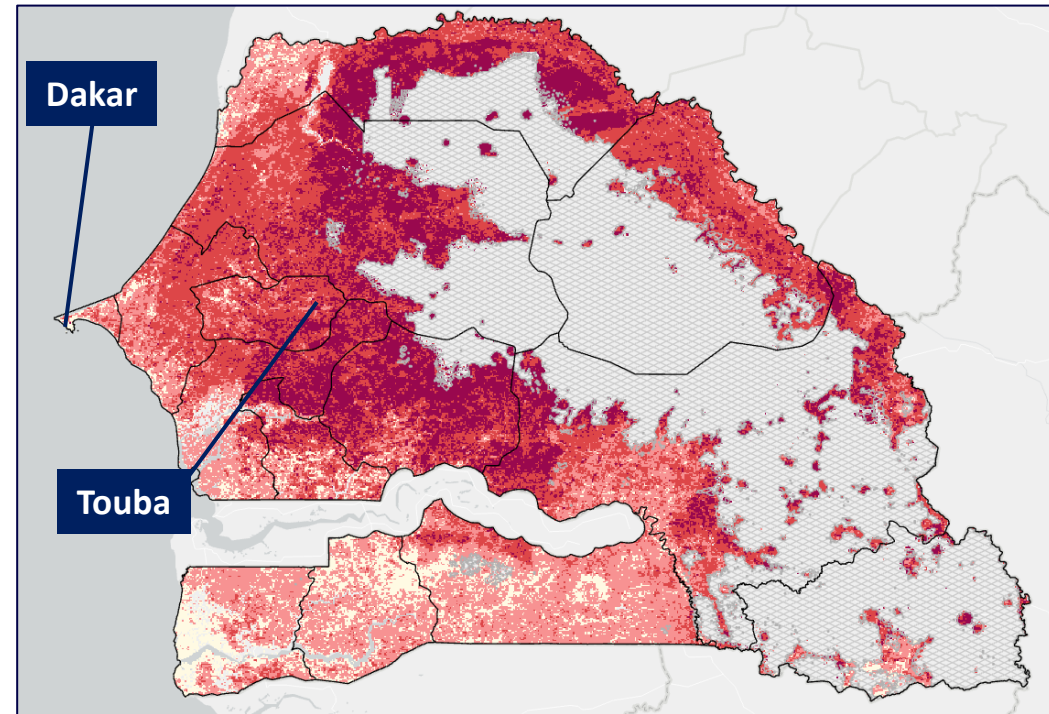**Source:** Fraym, Senegal DHS 2016, WorldPop 2020

Communities classified as high risk for child marriage due to women's limited participation in decision-making are also communities with high prevalence, with the except of the South.

Child Marriage Prevalence

Women's Limited Participation in Decision-Making Risk Category[1]

Dakar

Touba

Percent of women (aged 20-24) who were married before 18

0%   65%+

Areas with total population less than 10 people per sq km

City Large cities

Low Risk

Medium-Low Risk

Medium-High Risk

High Risk

Note 1: The map shows the classification of currently married women aged 15 to 49 who do not participate in any household decisions for each 1km² cell into quartiles. The risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Please see slide 53 or the appendix for more details.
**Source:** Fraym, Senegal DHS 2016, WorldPop 2020

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AT-RISK POPULATION || BEHAVIORS & CHILD MARRIAGE (RISK PROFILE MAPPING)

Departments with higher child marriage prevalence tend to be classified as higher risk for child marriage due to gender inequitable attitudes, although there is notable variation in risk categories.

Average Women's Participation in Decision-Making Index Risk Category and Child Marriage Prevalence

Each dot represents a department.

Source: Fraym
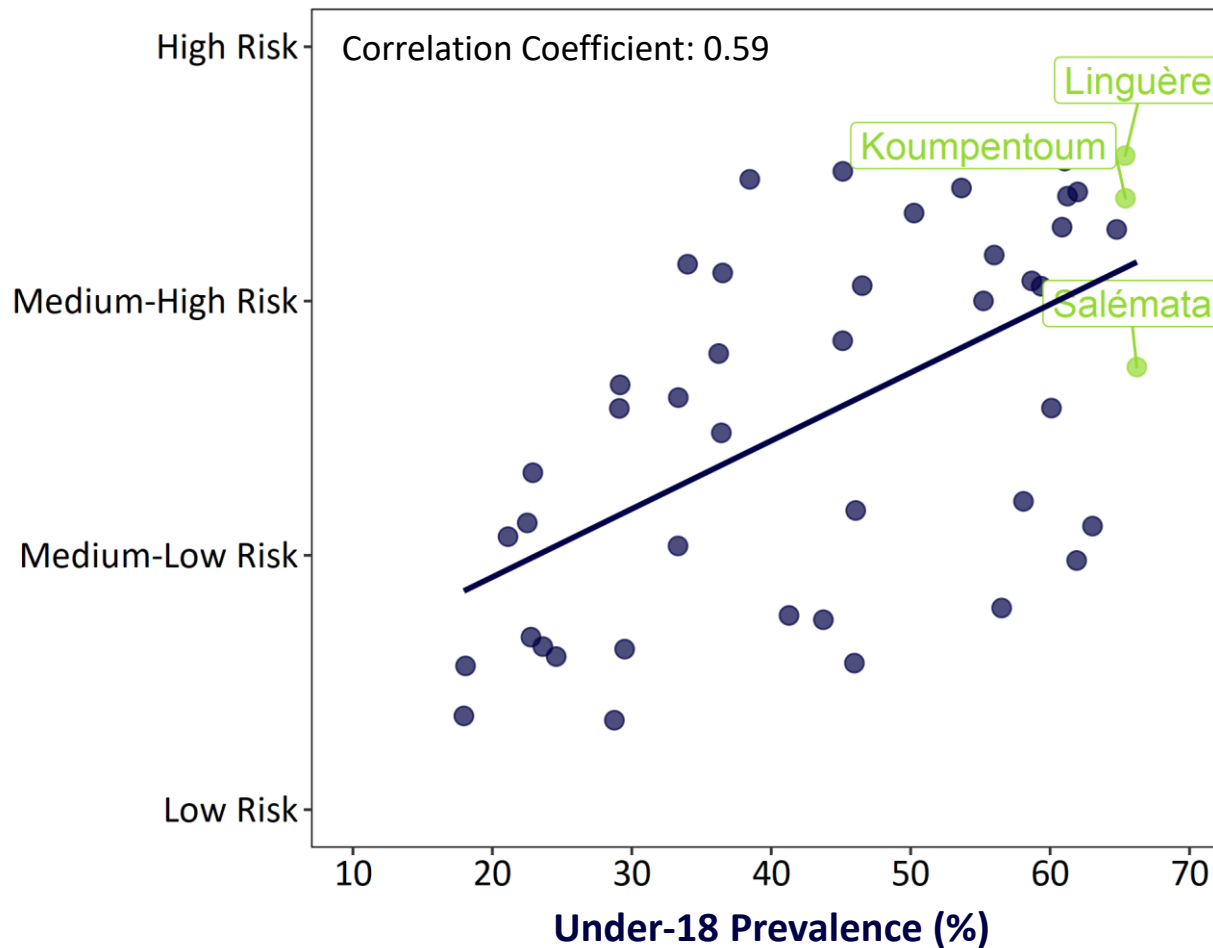
Fraym combined each risk factor profile to assess total risk at the community level.

1 Total risk is the sum of all risk factor profiles that exhibit a relationship with child marriage prevalence, including poverty and gender equitable attitudes and behaviors. Each profile is equally weighted.[1]

2 The total risk ranges on a 3 to 12 scale, with 12 indicating the highest level of risk. Communities with a score of 12 are classified as high risk on all profiles.

3 Very few communities are classified as high-risk on all profiles (or have a score of 12).

Note 1: In Senegal, pregnancy outside of marriage is very uncommon and is thus, unlikely to be a strong risk factor for child marriage. Accordingly, Senegal's total risk profile ranges on a scale from 3 to 12, while other countries in our analysis include the pregnancy risk factor and have a total risk profile score ranging from 4 to 16.
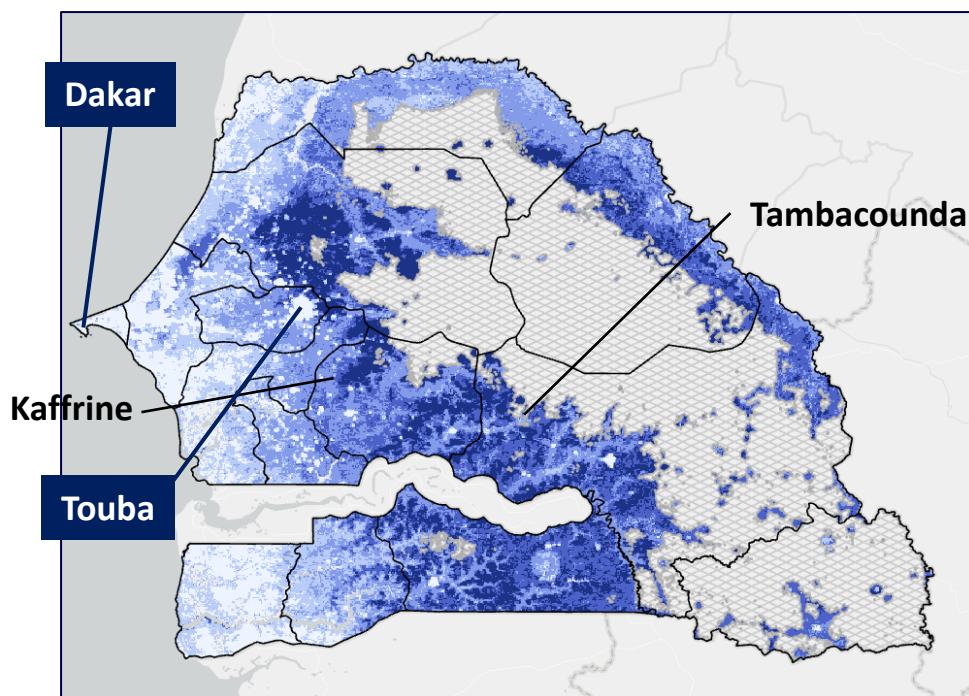
Some communities that exhibit high risk for child marriage across all profiles also have high under-18 prevalence, such as parts of Kaffrine and Tambacounda.

Total Risk
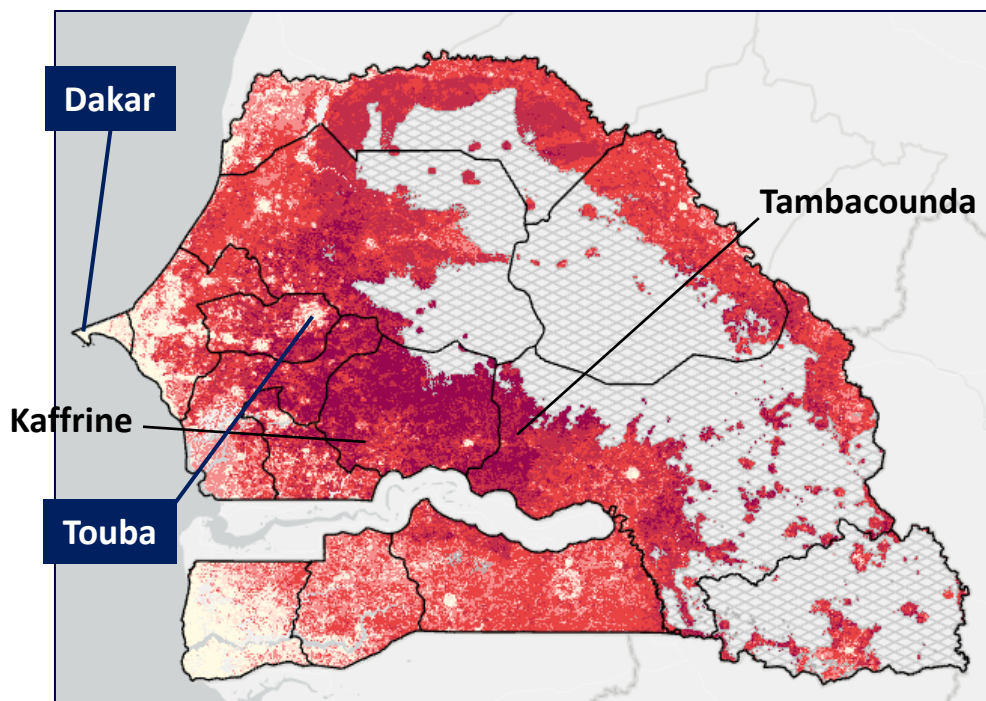
Child Marriage Prevalence

Total Risk

Low Risk — High Risk

Areas with total population less than 10 people per sq km

City — Large cities

Percent of women (aged 20-24) who were married before 18

0% — 65%+

Note 1: The total risk categories range on a 3 to 12 scale, with 12 indicating the highest level of risk. The index is the sum of poverty and gender equitable attitudes and decision-making, and equally weights each component.
Source: Fraym, Senegal DHS 2016, WorldPop 2020

AT-RISK POPULATION || KEY TAKEAWAYS

Poverty and gender inequitable attitudes and behaviors as risk factors are most strongly associated with child marriage, whereas pregnancy is an unlikely risk factor.

1. **Pregnancy outside of marriage is very uncommon in Senegal** and is thus unlikely to be a strong risk factor for child marriage.

2. **Fraym's analysis indicates that poverty is an important risk factor for child marriage in Senegal**. There are an estimated 225,000 girls aged 10 to 14 who live in communities where poverty represents a high risk for child marriage.

3. **Communities with gender inequitable attitudes, measured as attitudes towards wife beating, are widespread, whereas communities where decision-making behavior represents a high risk for child marriage are centrally located in the country**. There are an estimated 655,000 girls aged 10 to 14 in communities where attitudes are a high risk and 130,000 girls in communities where decision-making represents a high risk.

4. **In regions like Kaffrine and Tambacounda, communities have high total risk and have a high under-18 prevalence rate**. In Kolda, few communities are high total risk whereas under-18 child marriage is more widespread.

Hotspot Analysis

Bringing together the previous sections, Fraym identified two hotspots for child marriage: Tambacounda and Kolda regions.

1   Fraym defined hotspots as **regions with particularly high child marriage prevalence and/or burden**, and high concentrations of risk factors for child marriage.

2   For each hotspot, Fraym zoomed into the region of interest and **summarized key indicators, assessed the population of at-risk girls for each risk factor, and mapped the presence of infrastructure** (e.g. roads and health centers). Infrastructure affects service delivery, which may have implications for child marriage.

3   **Tambacounda region had the highest under-18 and under-15 prevalence and burden of child marriage in 2016.** In addition to this, an estimated 62 percent of girls aged 10-14 are at a high risk for child marriage due to poverty as a risk factor, the third highest proportion among all regions.

4   **Kolda region had the second highest regional prevalence for under-18 child marriage and the third highest rate for under-15 child marriage.** Interestingly, Kolda is the region with the second largest decrease in under-18 prevalence. Still, an estimated 63 percent of girls aged 10-14 are at a high risk of poverty as a risk factor for child marriage.

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HOTSPOT ANALYSIS || TAMBACOUNDA REGION (OVERVIEW)

Tambacounda has the highest prevalence and burden of both under-18 and under-15 marriage in the country.
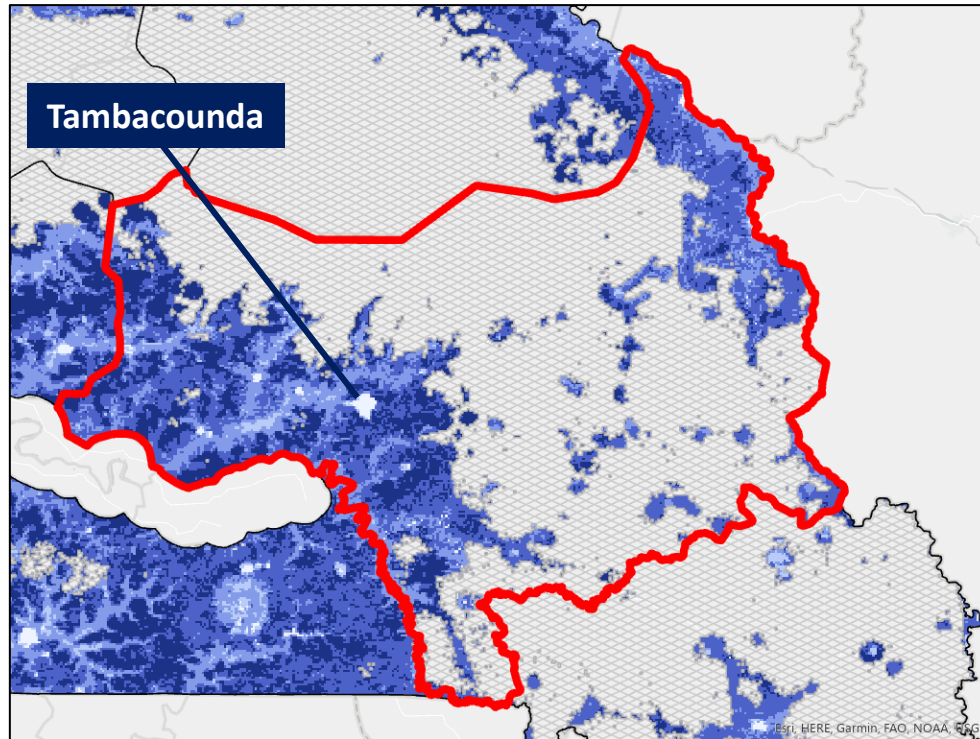
Tambacounda

Percent of women (aged 20-24) who were married before 18

0%   65%+

Areas with total population less than 10 people per sq km

City Region capital

Key Indicators	
Under-18 Prevalence	61%
Under-18 Burden	16,900
Proportion of adults (aged 15-49) who are employed	60%
Percent of women (aged 15-49) who are employed	40%
Percent of women (aged 18-49) who completed primary education or higher	8%
Percent of women (aged 15-24) who are sexually active and use a modern contraceptive method	4%
Percent of individuals in households with access to electricity	19%
Percent of individuals in households with a flush toilet	2%

Source: Fraym, Senegal DHS 2016
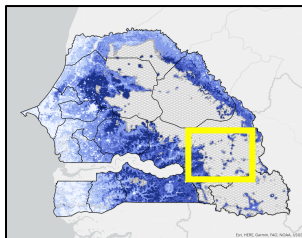
HOTSPOT ANALYSIS || TAMBACOUNDA REGION (RISK PROFILE MAPPING)

In Tambacounda, many communities are categorized as very poor.

Poverty Index Risk Category[1]

Legend:
- Low Risk
- Medium-Low Risk
- Medium-High Risk
- High Risk
- Areas with total population less than 10 people per sq km
- **City** Region capital
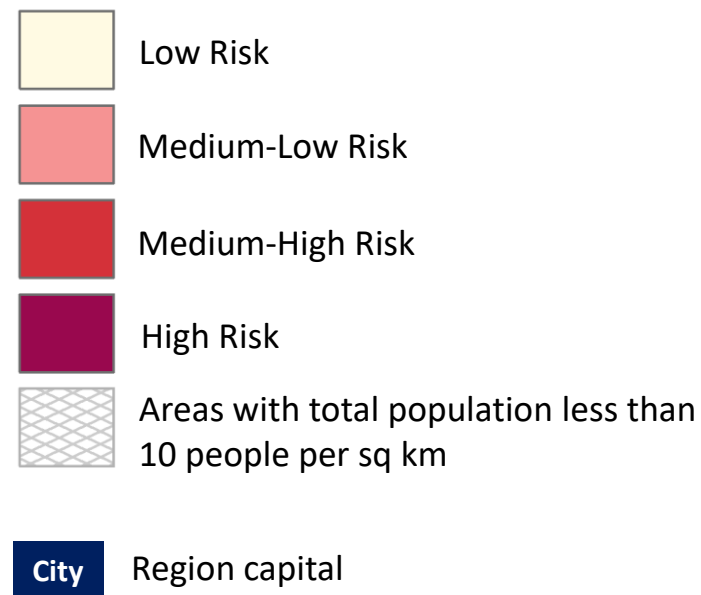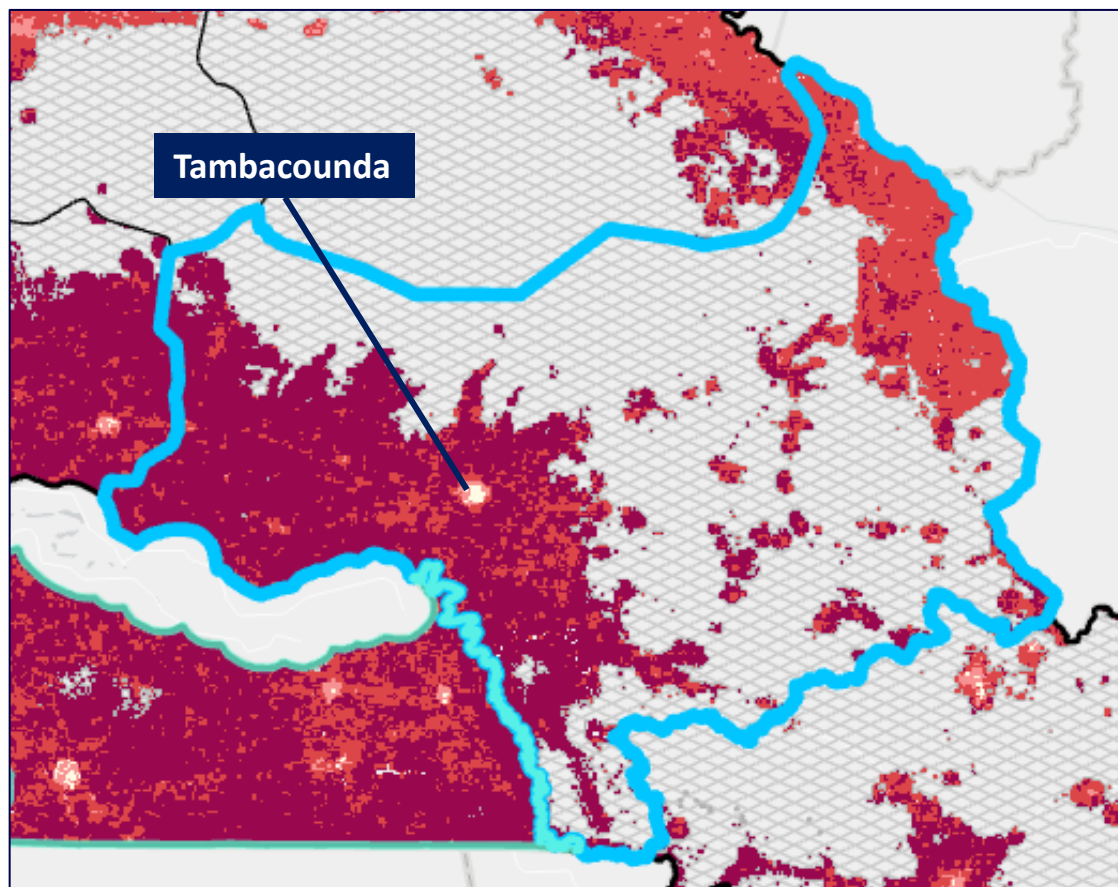
Population of at-risk girls (aged 10-14) due to poverty as a factor[2] — 32,000

 Note 1: The map shows the classification of the poverty index for each 1km^2 cell into quartiles. The poverty index risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. See slide 43 or the appendix for more details.
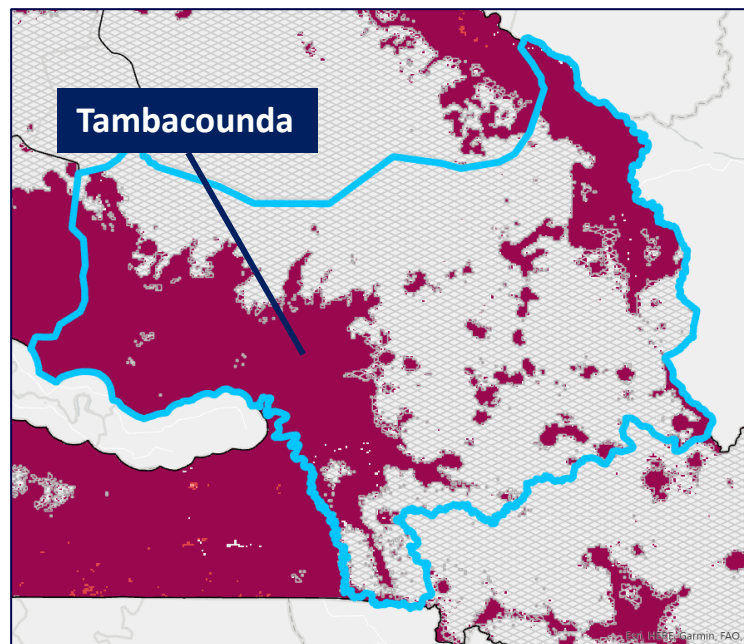**Note 2:** At-risk girls are defined as girls at risk for child marriage, that is girls aged 10-14 who live in communities with a poverty index risk category equal to 4 (highest risk).
Source: Fraym, Senegal DHS 2016, WorldPop 2020

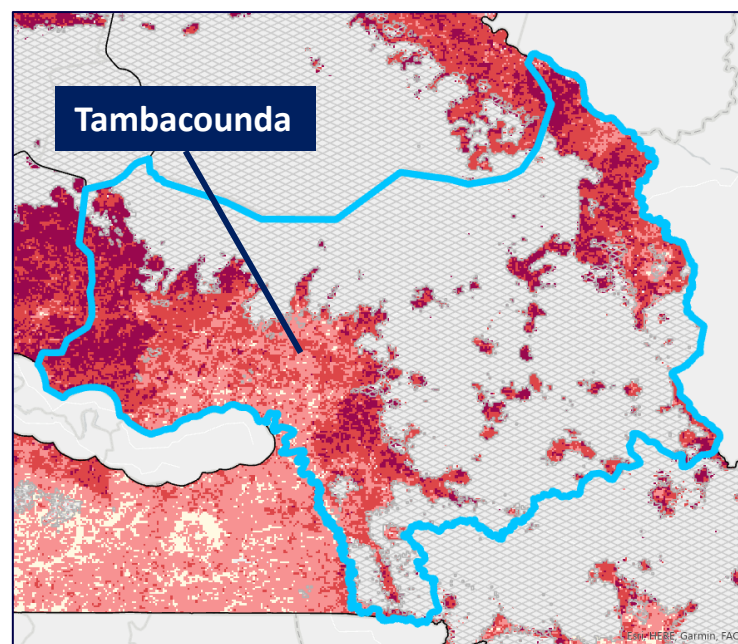# HOTSPOT ANALYSIS || TAMBACOUNDA REGION (RISK PROFILE MAPPING)

Most communities are categorized as high risk for child marriage due to gender inequitable attitudes, whereas decision-making poses less of a risk factor.

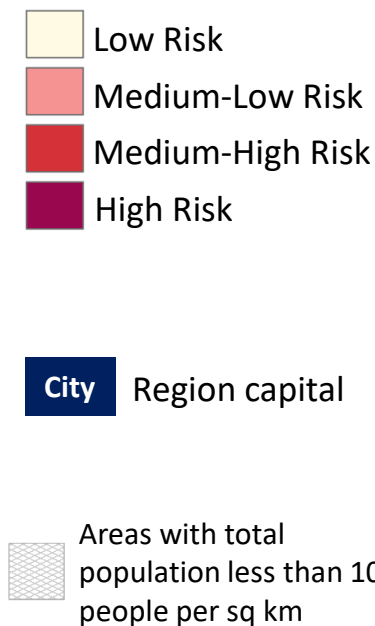### Attitudes Towards Wife Beating Risk Category[1]

Tambacounda

Women's Participation in Decision-Making Risk Category[2]

Tambacounda

Legend:
- Low Risk
- Medium-Low Risk
- Medium-High Risk
- High Risk

City Region capital

Areas with total population less than 10 people per sq km

Total number of at-risk girls (aged 10-14) due to attitudes as a factor[3]	52,000

Total number of at-risk girls (aged 10-14) due to decision-making as a factor[3]	14,000

Note 1: The map shows the classification of attitudes towards wife beating for each 1km² cell into quartiles. The attitudes towards wife beating risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Attitudes towards wife beating is defined as belief that there is at least one reason that justifies wife beating. Please see slide 48 or the appendix for more details.

Note 2: The map shows the classification of women's lack participation in decision-making index for each 1km² cell into quartiles. The risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Please see slide 53 or the appendix for more details.

Note 3: At-risk girls are defined as girls at risk for child marriage, that is girls aged 10-14 who live in communities with an attitudes towards wife beating risk category or decision-making index risk category equal to 4 (highest risk).

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HOTSPOT ANALYSIS || TAMBACOUNDA REGION (INFRASTRUCTURE AND SERVICES)

Some communities in Tambacounda have limited major transportation infrastructure, although health center coverage is above the national average.
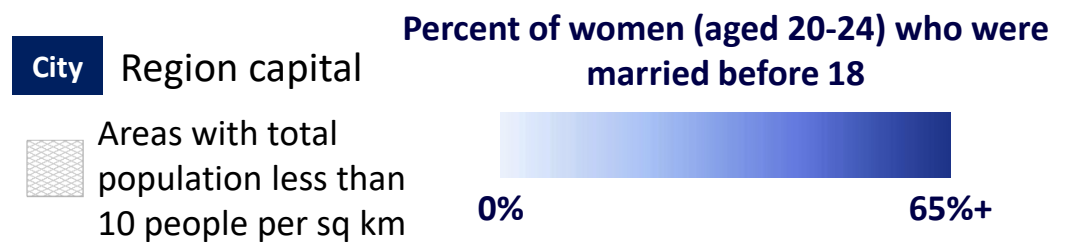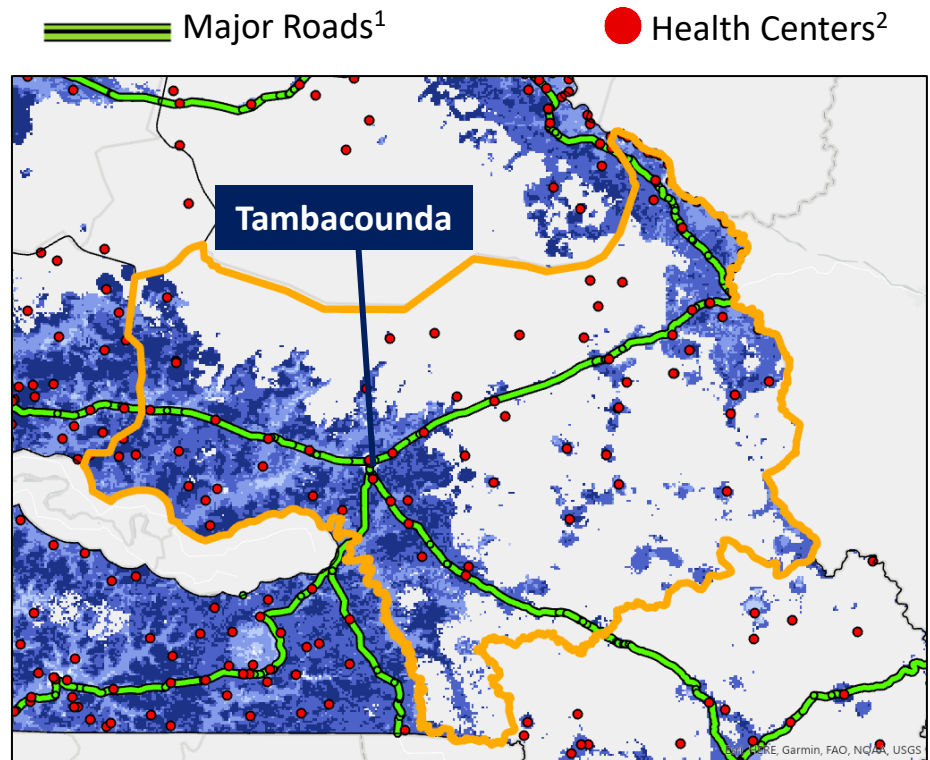
Infrastructure in Tambacounda

════ Major Roads[1]   🔴 Health Centers[2]

Tambacounda

Esri, HERE, Garmin, FAO, NOAA, USGS

1 There are a few major transborder roads that all run through the capital city of Tambacounda. Some high prevalence communities, like in the southeast, may have limited connectivity.

2 There are roughly 11 public health centers per 100,000 people, which is above the national rate (7 per 100,000 people). Health centers are evenly distributed throughout the region, apart from a few pockets in the south.

City Region capital

Areas with total population less than 10 people per sq km

Percent of women (aged 20-24) who were married before 18

0%   65%+

Note 1: Major roads include motorways, trunk roads, and primary roads, which are the most important roads in a country's road network.
Note 2: Public health centers come from the World Health Organization
Source: Fraym, Senegal DHS 2016, WHO, OpenStreetMaps

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HOTSPOT ANALYSIS || TAMBACOUNDA REGION (DEPARTMENT-LEVEL DATA)

Koumpentoum department has the highest under-18 prevalence rate and the lowest female employment rate in the country.

| Indicator	Bakel	Goudiry	Koumpentoum	Tambacounda
Child Marriage				
Under-18 Prevalence	59%	65%	65%	60%
Population of At-Risk Girls (aged 10-14), by Profile[1]				
Poverty	1,600	4,600	9,200	16,500
Gender Inequitable Attitudes	12,000	7,400	10,200	21,800
Limited Decision-Making	3,100	3,200	5,000	2,400
Community Characteristics				
Total Population	16,900	81,200	162,500	340,400
Number of Health Centers Per 100,000 People	19	26	7	6
Percent of women (aged 15-49) who are employed	33%	40%	40%	43%
Percent of women (aged 18-49) who completed primary education or higher	8%	6%	5%	10%

Note 1: The total number of at-risk girls for pregnancy outside of marriage is exclude as it was determined to be an unlikely risk factor for child marriage in Senegal.
Source: Fraym

Kolda has the second highest under-18 prevalence rate in Senegal. High prevalence areas are dispersed throughout the region but lowest in urban areas.

Under-18 Prevalence

Kolda
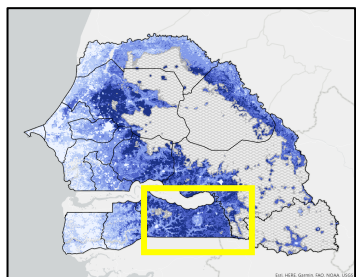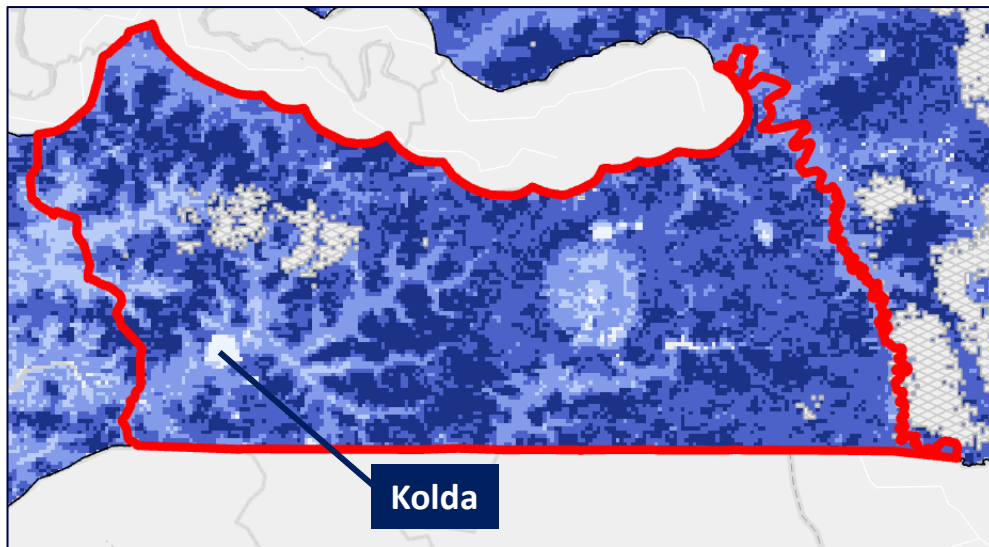
Percent of women (ages 20-24) who were married before 18

0%   65%+

Key Indicators	
Under-18 Prevalence	60%
Under-18 Burden	18,100
Percent of adults (aged 15-49) who are employed	58%
Percent of women (aged 15-49) who are employed	45%
Percent of women (aged 18-49) who completed primary education or higher	16%
Percent of women (aged 15-24) who are sexually active and use a modern contraceptive method	6%
Percent of individuals in households with access to electricity	24%
Percent of individuals in households with a flush toilet	4%

Areas with total population less than 10 people per sq km

City   Region capital

HOTSPOT ANALYSIS || KOLDA REGION (RISK PROFILE MAPPING)

Kolda has the third highest population of at-risk girls due to poverty. The capital city of Kolda has a lower risk compared to the rest of the region.

Poverty Index Risk Category[1]

	Low Risk
	Medium-Low Risk
	Medium-High Risk
	High Risk
	Areas with total population less than 10 people per sq km
City	Region capital

Population of at-risk girls (aged 10-14) due to <u>poverty</u> as a factor	30,500

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HOTSPOT ANALYSIS || KOLDA REGION (RISK PROFILE MAPPING)

Most communities in Kolda are categorized as high-risk for child marriage due to gender inequitable attitudes, whereas limited decision-making represents a much lower risk.

Attitudes Towards Wife Beating Risk Category[1]

Kolda

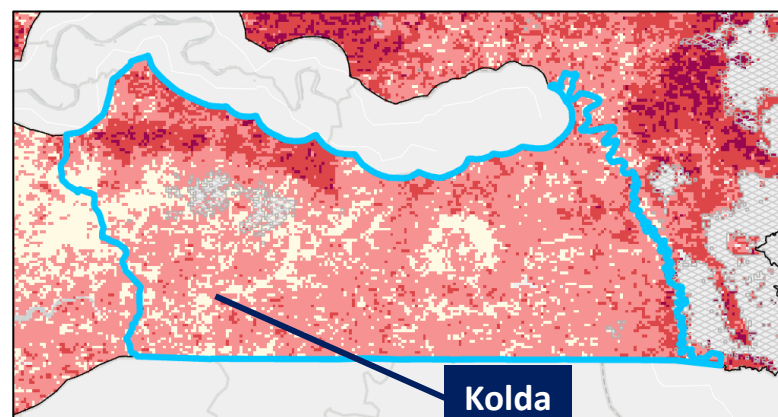|		
Low Risk		
Medium-Low Risk		
Medium-High Risk		
High Risk		
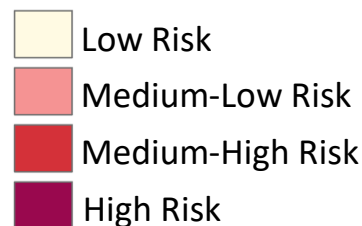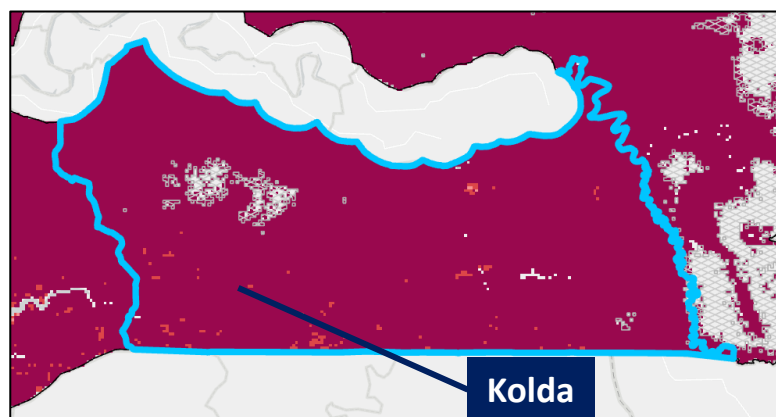
City Region capital

Areas with total population less than 10 people per sq km

Population of at-risk girls (aged 10-14) due to <u>attitudes</u> as a factor[3]	47,000

Women's Participation in Decision-Making Index Risk Category[2]

Kolda

Population of at-risk girls (aged 10-14) due to <u>decision-making</u> as a factor[3]	300

Note 1: The map shows the classification of attitudes towards wife beating for each 1km² cell into quartiles. The attitudes towards wife beating risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Attitudes towards wife beating is defined as belief that there is at least one reason that justifies wife beating. Please see slide 48 or the appendix for more details.

Note 2: The map shows the classification of women's lack participation in decision-making index for each 1km² cell into quartiles. The risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Please see slide 53 or the appendix for more details.

Note 3: At-risk girls are defined as girls at risk for child marriage, that is girls aged 10-14 who live in communities with an attitudes towards wife beating risk category or decision-making index risk category equal to 4 (highest risk).

Source: Fraym, Senegal DHS 2016, WorldPop 2020

HOTSPOT ANALYSIS || KOLDA REGION (INFRASTRUCTURE AND SERVICES)

While populous, Kolda's major road infrastructure is largely concentrated in the south and east of the region. High prevalence areas in the northwest might lack access to major roadways.

1 Throughout Kolda, there is limited major road infrastructure, which primarily runs east to west through the regional capital. Many communities, especially in the northwest, which has high prevalence, have limited access to transportation.

2 There are roughly 6 public health centers per 100,000 people, which is slightly lower than the national rate (7 per 100,000 people). Lack of access to health services could have negative implications for women married as children.

Infrastructure in Kolda

Major Roads[1]   ● Health Centers[2]
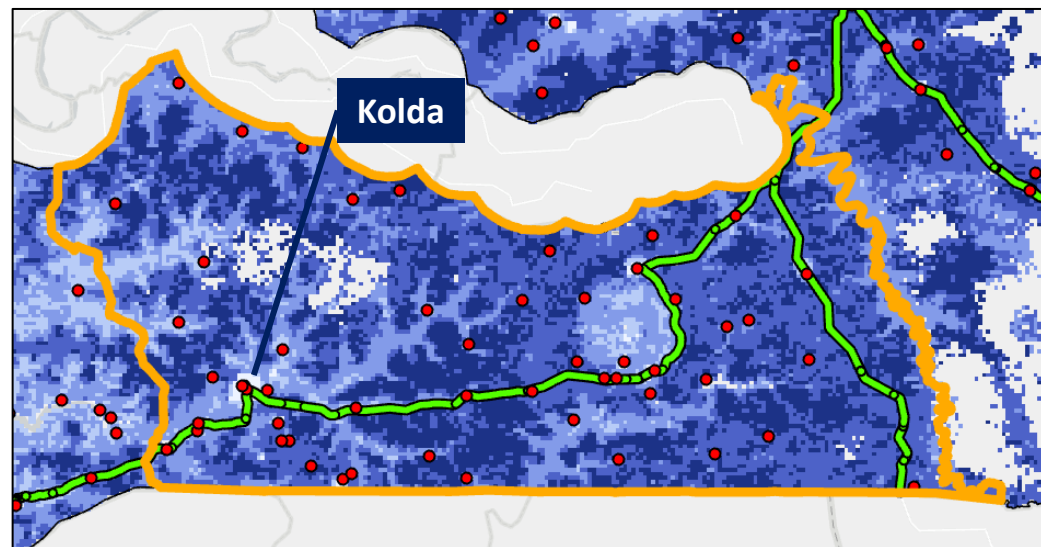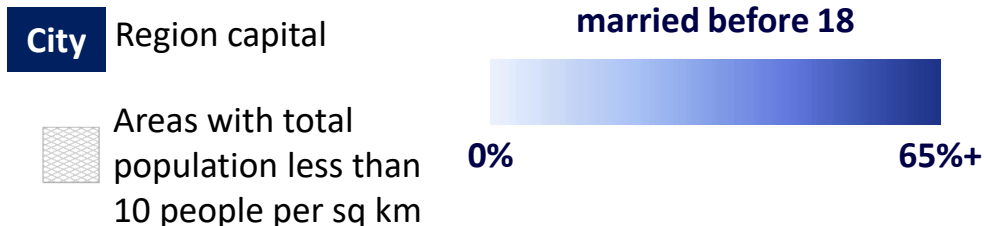
City Region capital

Areas with total population less than 10 people per sq km

Percent of women (aged 20-24) who were married before 18

0%   65%+

Note 1: Major roads include motorways, trunk roads, and primary roads, which are the most important roads in a country's road network.
Note 2: Public health centers come from the World Health Organization
Source: Fraym, Senegal DHS 2016, WHO, OpenStreetMaps

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Médina Yoro Foulah department has the highest under-18 prevalence rate, and large numbers of at-risk girls for poverty and attitudes.

Indicator	Kolda	Médina Yoro Foulah	Vélingara
Child Marriage			
Under-18 Prevalence	56%	63%	62%
Population of At-Risk Girls (aged 10-14), by Profile[1]			
Poverty	10,400	7,600	12,300
Gender Inequitable Attitudes	17,100	9,800	20,400
Limited Decision-Making	<10	300	20
Community Characteristics			
Total Population	310,300	172,500	358,800
Number of Health Centers Per 100,000 People	8	6	5
Percent of women (aged 15-49) who are employed	43%	50%	45%
Percent of women (aged 18-49) who completed primary education or higher	22%	10%	14%

Note 1: The total number of at-risk girls for pregnancy outside of marriage is exclude as it was determined to be an unlikely risk factor for child marriage in Senegal.
Source: Fraym

Appendix

APPENDIX|| DEFINITIONS

Indicator	Description
Child Marriage	
Under-18 Child Marriage Prevalence	Percent of women (aged 20-24) who were married before age 18. Women married before age 18 include both those who are currently married and formerly married. Per the DHS, those who report that they are married or living with a partner are considered in union and therefore this indicator is based off the age at first marriage or co-habitation.
Under-18 Child Marriage Burden	The number of women (aged 20-24) who were married before age 18. Burden is calculated using population data from WorldPop.
Under-15 Child Marriage Prevalence	Percent of women (aged 20-24) who were married before age 15. Women married before age 15 include both those who are currently married and formerly married. Per the DHS, those who report that they are married or living with a partner are considered in union and therefore this indicator is based off the age at first marriage or co-habitation.
Under-15 Child Marriage Burden	The number of women (aged 20-24) who were married before age 15. Burden is calculated using population data from WorldPop.

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Note: All indicators are from the 2016 Senegal DHS. Child marriage prevalence is also calculated using the 2011 Senegal DHS and 2005 Senegal DHS.

APPENDIX || DEFINITIONS

Indicator	Description
Community Context	
Adult Employment	Percent of adults (aged 15-49) who are employed. An adult is employed if he or she reports working in the last 7 days.
Adult Female Employment	Percent of women (aged 15-49) who are employed. A woman is employed if she reports working in the last 7 days.
Female Educational Attainment	Percent of women (ages 18-49) who completed primary school or higher.
Male Educational Attainment	Percent of men (aged 18-49) who completed primary school or higher.
Modern Contraceptive Use	Percent of women (aged 15-24) who are sexually active and use a modern contraceptive method. Per the DHS, modern methods exclude periodic abstinence and withdrawal, which are considered traditional methods.
Health System Usage	Percent of women (aged 15-49) who visited a health facility or have been visited by a fieldworker to talk about family planning in the past 12 months.
Child Stunting	Percent of children under five who are stunted.
Access to Electricity	Percent of individuals that live in a household with access to electricity.
Flush Toilet	Percent of individuals that live in a household with a flush toilet.

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Note: All indicators are from the 2016 Senegal DHS. Child marriage prevalence is also calculated using the 2011 Senegal DHS and 2005 Senegal DHS.

APPENDIX|| DEFINITIONS

Indicator	Description
Risk Profiles	
Poverty	Fraym selected four indicators to capture child marriage related poverty: (i) wealth; (ii) employment in unskilled manual labor or self-employment in agriculture for women aged 15 to 24; (iii) educational attainment of the household head; and (iv) employment in unskilled manual labor or self-employment in agriculture for the household head. Fraym then combined these indicators using a principal components analysis (PCA) to produce an index. The poverty index risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk.
Attitudes towards Wife Beating	Attitudes towards wife beating is defined as the percent of adults aged 15 to 49 who agree with at least one reason that a husband is justified in hitting or beating his wife. Respondents were asked whether a husband is justified in beating his wife under a series of circumstances: if the wife burns the food, argues with him, goes out without telling him, neglects the children, or refuses sexual relations. The attitudes towards wife beating risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk.
Women's Limited Participation in Decision Making	Women's limited participation in decision-making is defined as the percent of currently married women aged 15 to 49 who report that they do not participate in any of the four major household decisions: (i) woman's health care; (ii) large household purchases; (iii) visits to family; and (iv) husband's earnings. Due to differences in the survey design for India as compared to other countries Fraym analyzed, Fraym modified the approach to this profile by using a single indicator rather than using PCA to create an index. The women's participation in decision-making index risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk.

Note: All indicators are from the 2016 Senegal DHS. Child marriage prevalence is also calculated using the 2011 Senegal DHS and 2005 Senegal DHS.

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APPENDIX || DATA AND METHODOLOGY

Fraym Data Sources

The Fraym platform weaves together the latest satellite imagery and geostatistical datasets with professionally enumerated household surveys. This allows for the disaggregation and re-aggregation of large datasets to cover any geographically bounded area.

For this report, indicators at the individual and household levels were sourced from the 2016 Senegal Demographic and Health Survey (DHS), 2011 DHS, and 2005 DHS.

Additionally, granular population distribution data comes from WorldPop, a publicly available and detailed population distribution and composition data source that leverages existing census data to produce 100m x 100m resolution estimates of population density. In order to build its datasets, WorldPop relies on census data as the main primary data input, and large geotagged household surveys when they are not available. In order to project into the future from the latest census of a given country, WorldPop uses subnational and urban rural growth rates that are reconciled with UN estimates. For this report, population estimates from 2020 were used for the community context indicators and risk profiles. For prevalence and burden, population data corresponding to the year of the survey was used (2016, 2011, and 2005).

Fraym Methodology

Fraym data scientists closely examine representativeness, sampling frames, questionnaire coverage, periodicity, and a range of other factors. **Fraym obtains microdata**, e.g. individual rows of responses of survey data, in order to avoid any manipulation that could potentially occur during the analysis phase.

In Sengal, the surveys were implemented by the Agence Nationale de la Statistique et de la Demographie (ANSD) with financial, technical, and managerial support by large **internationally respected organizations**, including the US Agency for International Development, UNICEF, and UNFPA. These surveys are designed to be representative of both the *de jure* and *de facto* populations.

These surveys typically use a **stratified, two-stage cluster design** that ensures representative samples for the national and subnational levels. After data collection, *post-hoc* sampling weights are created to account for any oversampling and ensure representativeness particularly at hyperlocal levels.
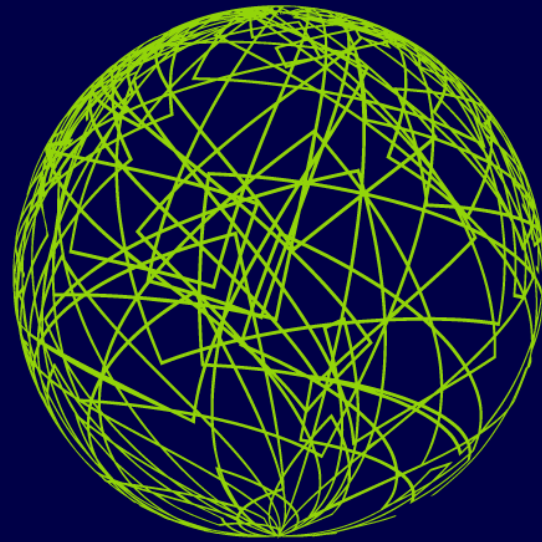
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