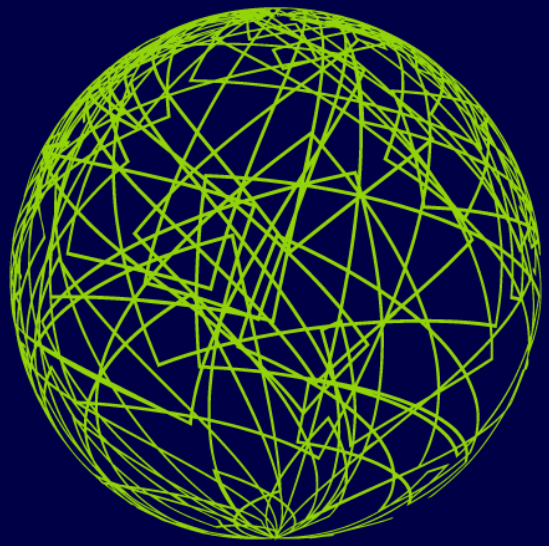

fraym

Analyzing Girl Child Marriage: Kenya Deep Dive

Prepared for the Child Marriage Learning Partners Consortium

With Support from the Bill & Melinda Gates Foundation

22 March 2021

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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.

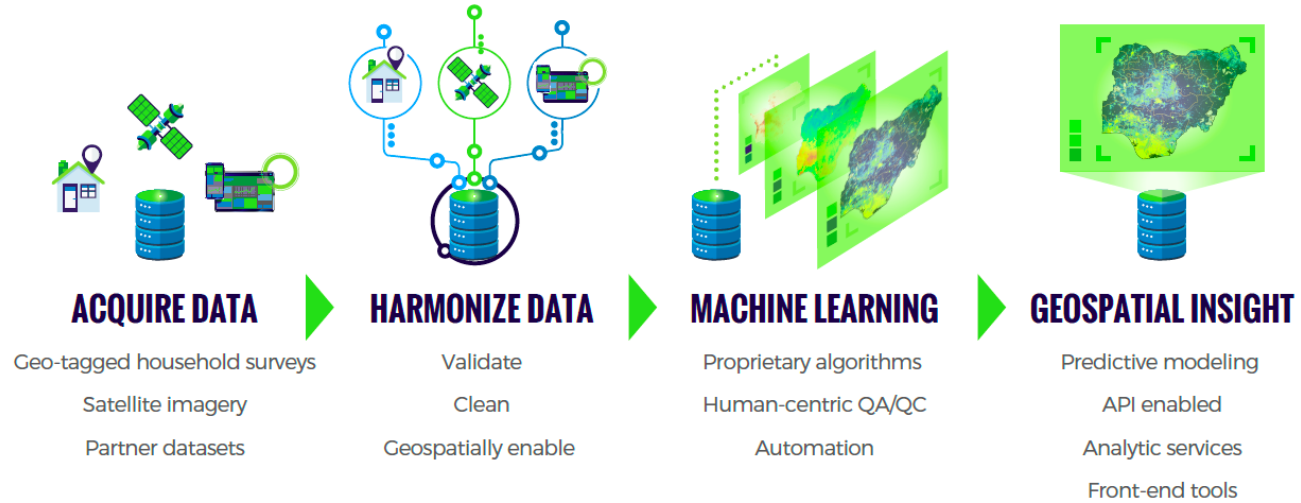
ABOUT FRAYM || METHODOLOGICAL APPROACH

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]



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

REPORT OVERVIEW || ANALYTIC FRAMEWORK

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

1. Fraym **mapped the prevalence and burden of under-18 and under-15 girl child marriage and analyzed spatiotemporal trends** from 2003, 2009, and 2014 in Kenya.

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 Kenya, Fraym used this same analytical framework to produce country reports for Bangladesh, Ethiopia, India, Malawi, Senegal, and Nigeria, as well as a cross-country synthesis report, as part of the Child Marriage Learning Partners Consortium.[1]

Note 1: 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.

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

1. National child marriage prevalence rates did not change substantially over time, but **sub-national variation suggests that high prevalence areas may be shifting from one community to another over time.**

2. Fraym **identified three counties as hotspots of child marriage**: (i) Turkana; (ii) Mandera; and (iii) Samburu. Turkana and Mandera counties have some of the highest under-18 prevalence rates. Samburu has the second highest under-15 prevalence rate.

3. **Communities where poverty represents a high risk factor for child marriage are widespread** throughout Kenya, whereas **communities with a high risk of child marriage due to pregnancy outside of marriage are most heavily concentrated around Lake Victoria**.

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

Mapping Prevalence and Burden

MAPPING PREVALENCE AND BURDEN || SECTION OVERVIEW

Fraym mapped the prevalence and burden of under-18 and under-15 child marriage and analyzed spatiotemporal trends spanning 2003 to 2014 in Kenya.

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 (2014), **Fraym mapped under-18 and under-15 child marriage prevalence and burden at the national, county, sub-county, and community level (1km^2)**.

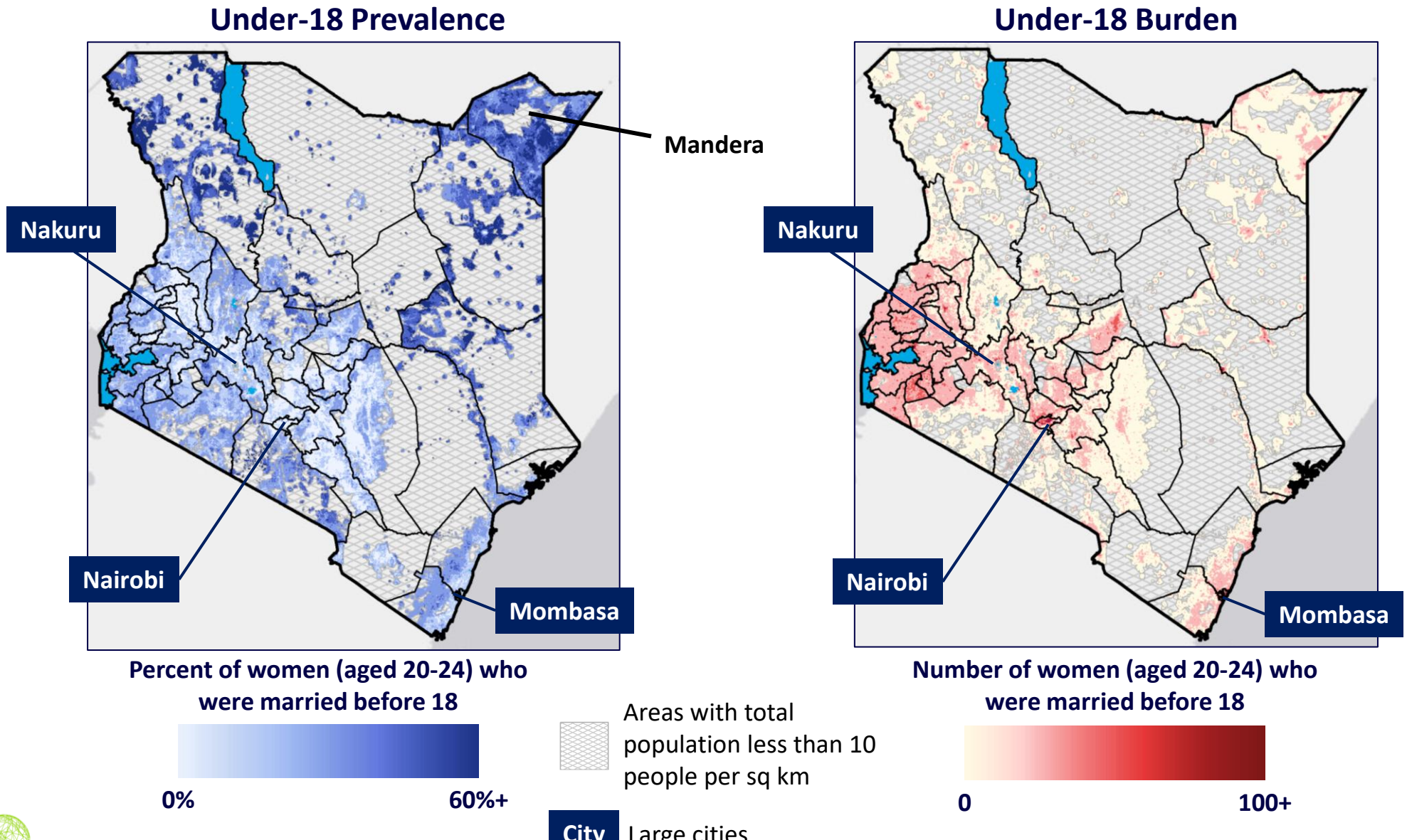
3. Next, Fraym examined two previous survey intervals (2003 and 2009) in order to **assess spatiotemporal trends across the full time period (2003 to 2014), as well as in shorter intervals (2003 to 2009 and 2009 to 2014).**

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 (2014)

Nationally, 25 percent of women aged 20-24, or 495,000 women, were married before age 18. Prevalence is highest in northern Kenya, particularly Mandera county, whereas the burden is more concentrated in population-dense cities.

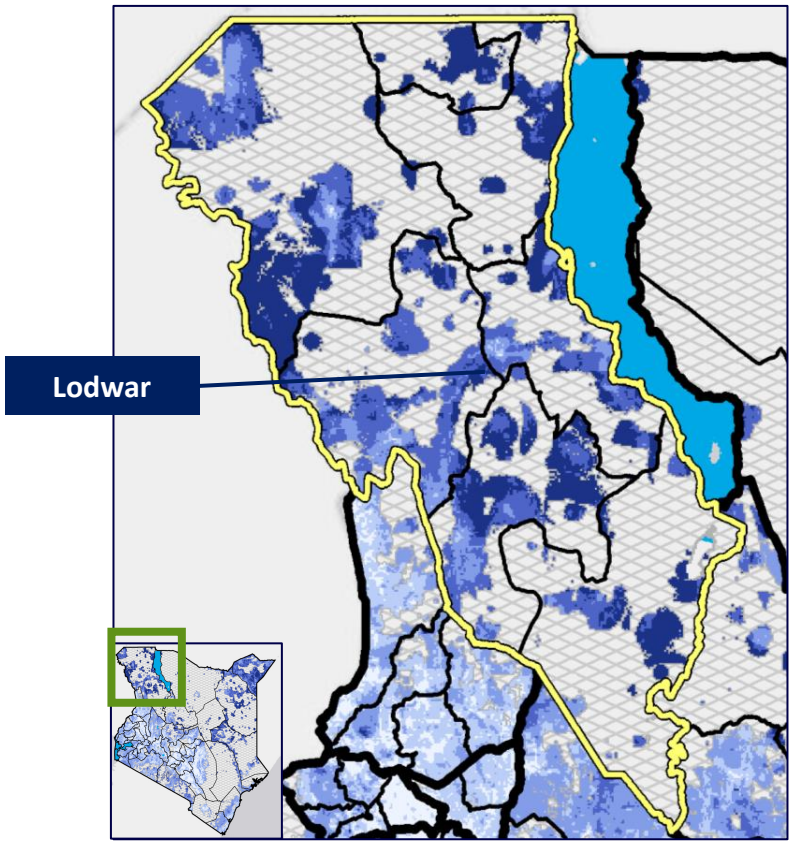


Source: Fraym, Kenya DHS 2014, WorldPop 2014

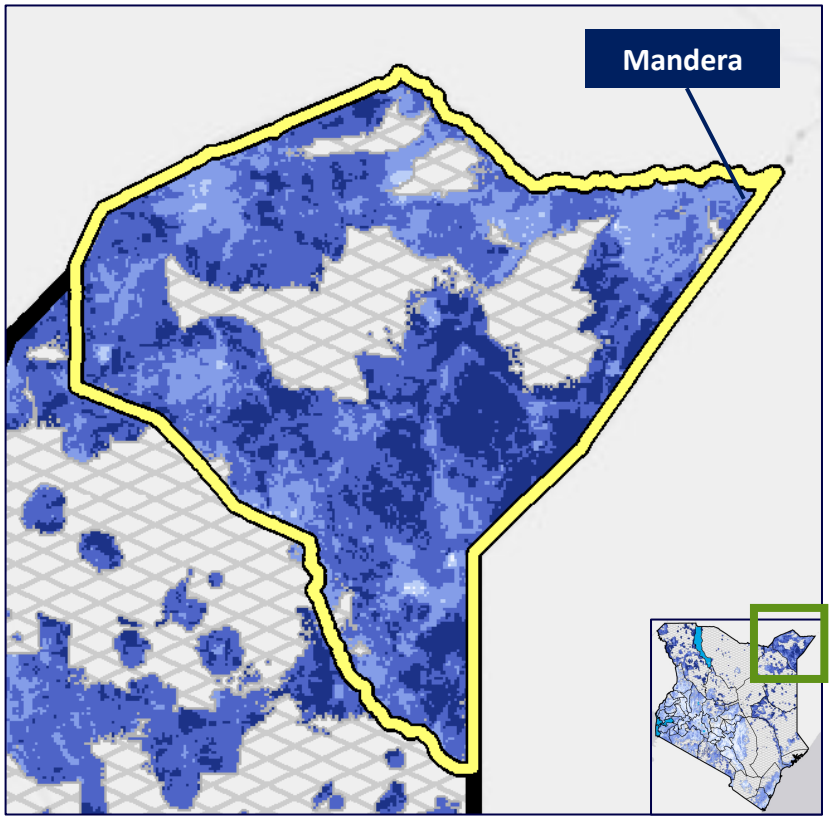
MAPPING PREVALENCE AND BURDEN || HIGH PREVALENCE COUNTY EXAMPLES

Turkana and Mandera counties both have high prevalence rates, but there are pockets of communities where child marriage is relatively uncommon.

Turkana county has the highest under-18 prevalence rate – 57%



Mandera county's under-18 prevalence rate is 49%, nearly double the national rate of 25%



Areas with total population less than 10 people per sq km

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

0% **60%+**

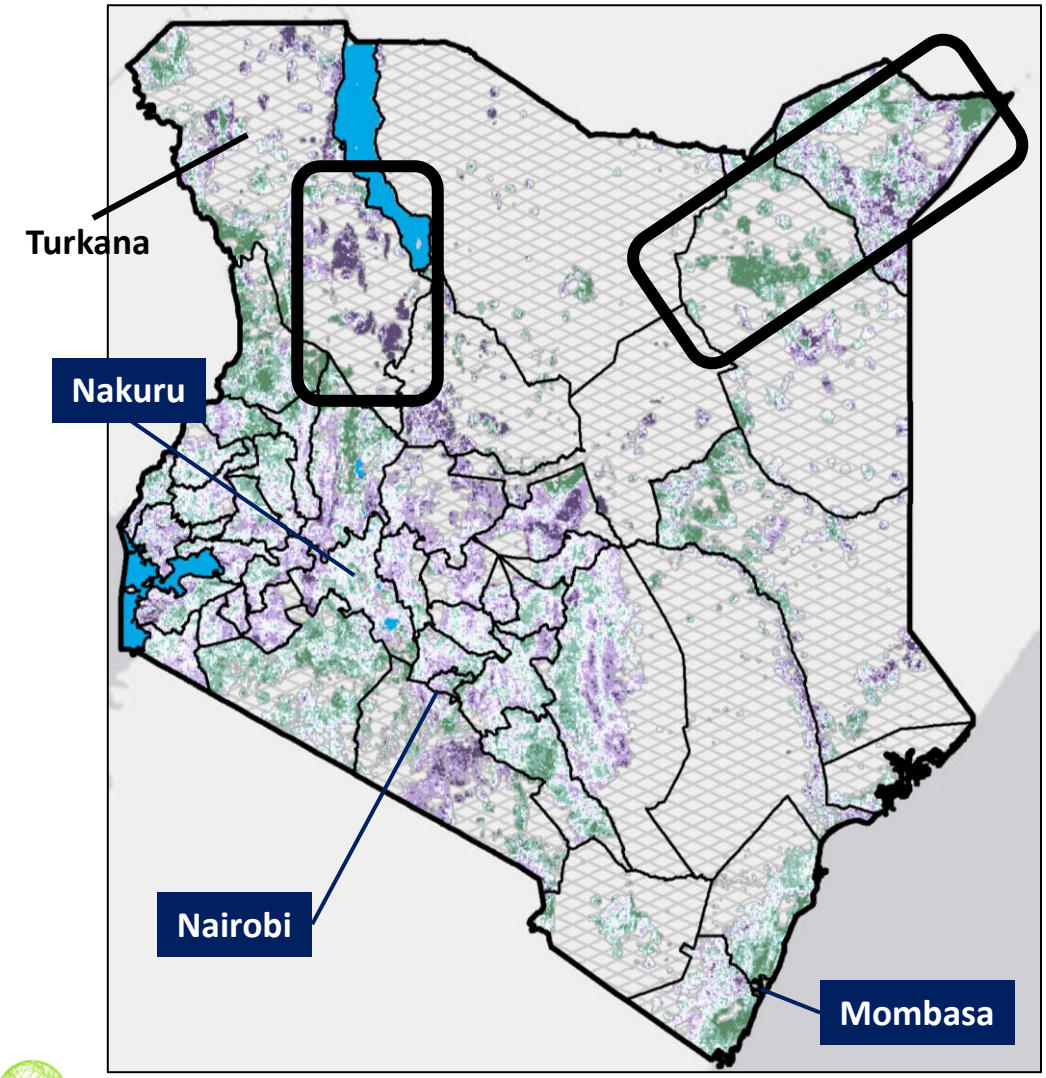
City County capital

Source: Fraym, Kenya DHS 2014

MAPPING PREVALENCE AND BURDEN || UNDER-18 TIME SERIES (2003 to 2014)

Pockets of Turkana county witnessed the most notable increase from 2003 to 2014, whereas under-18 prevalence decreased in western and northeast Kenya.

Change in the Prevalence of Under-18 Child Marriage: 2003 to 2014



National Under-18 Prevalence

2003	2014
25.9%	24.9%

Percentage Point (pp) Change in Under-18 Prevalence from 2003 to 2014

- -25+ pp
- -25 pp to -10 pp
- -10 pp to -3 pp

Decrease

- -3 pp to 3 pp
- 3 pp to 10 pp
- 10 pp to 25 pp
- 25+ pp

Increase

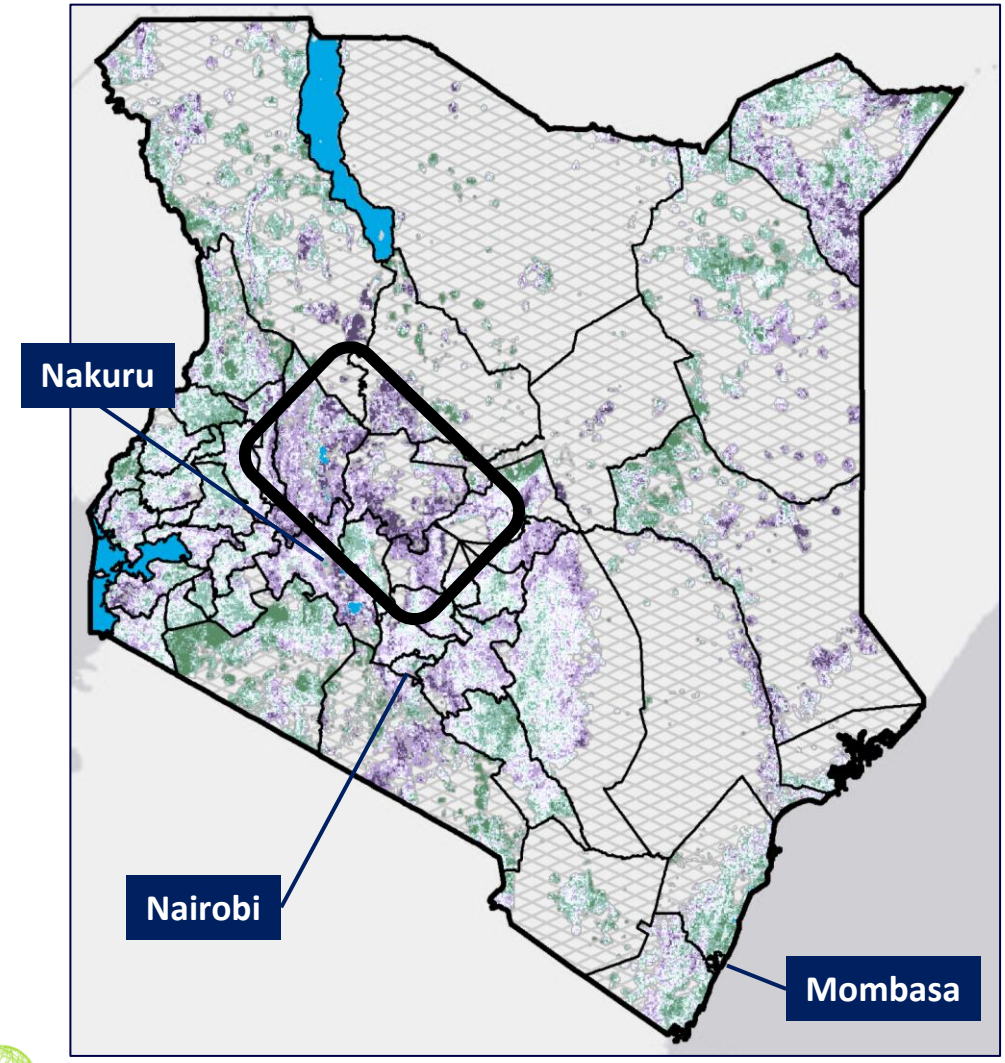
- Areas with total population less than 10 people per sq km
- Water bodies
- City — Large cities

Source: Fraym, Kenya DHS 2014 and 2003

MAPPING PREVALENCE AND BURDEN || UNDER-18 TIME SERIES INTERVAL (2003 to 2009)

From 2003 to 2009, areas in central Kenya saw an increase in the prevalence of under-18 child marriage.

Change in the Prevalence of Under-18 Child Marriage: 2003 to 2009



National Under-18 Prevalence

2003	2009
25.9%	25.2%

Percentage Point (pp) Change in Under-18 Prevalence from 2003 to 2009

- -25+ pp
- -25 pp to -10 pp
- -10 pp to -3 pp

Decrease

- -3 pp to 3 pp
- 3 pp to 10 pp
- 10 pp to 25 pp
- 25+ pp

Increase

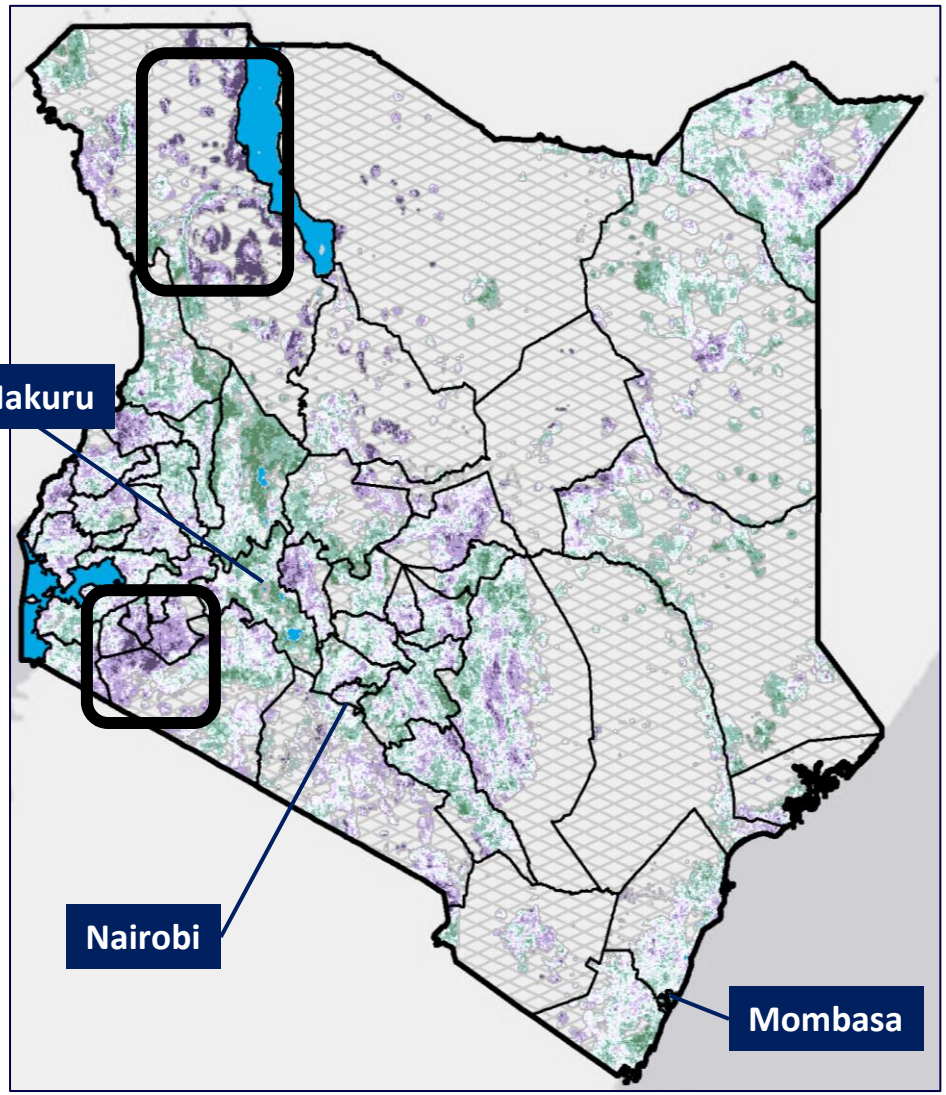
- Areas with total population less than 10 people per sq km
- Water bodies
- City — Large cities

Source: Fraym, Kenya DHS 2009 and 2003

MAPPING PREVALENCE AND BURDEN || UNDER-18 TIME SERIES INTERVAL (2009 to 2014)

Changes in under-18 prevalence rates also were mixed between 2009 and 2014, with rates increasing around Lake Turkana and in the southwest.

Change in the Prevalence of Under-18 Child Marriage: 2009 to 2014



National Under-18 Prevalence

2009	2014
25.2%	24.9%

Percentage Point (pp) Change in Under-18 Prevalence from 2009 to 2014

- -25+ pp
- -25 pp to -10 pp
- -10 pp to -3 pp

Decrease

- -3 pp to 3 pp
- 3 pp to 10 pp
- 10 pp to 25 pp
- 25+ pp

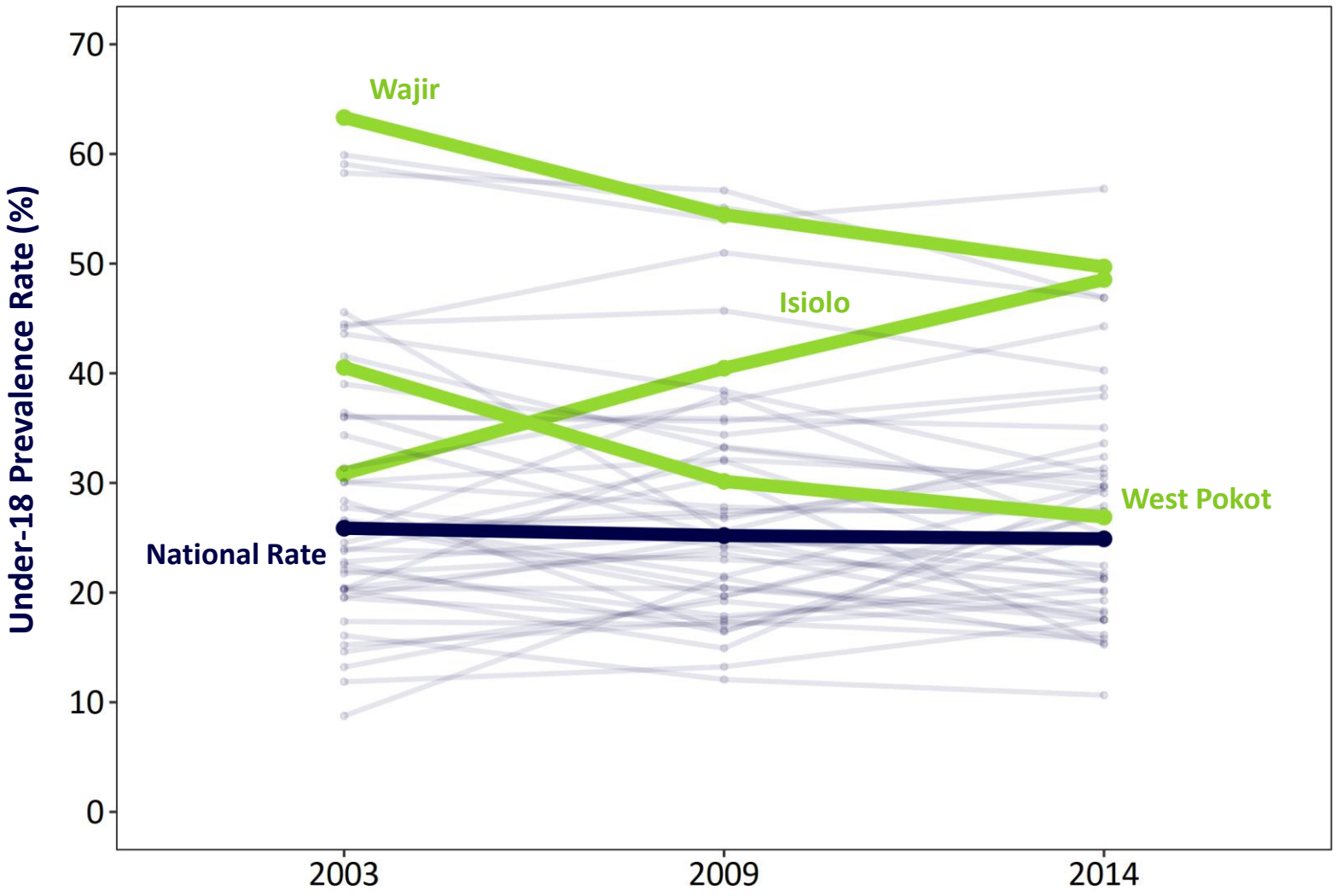
Increase

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

Source: Fraym, Kenya DHS 2014 and 2009

Overall, 60% of counties saw a decrease in under-18 prevalence between 2003 and 2014. Several counties, like Isiolo, witnessed notable increases.

Change in the Under-18 Child Marriage Prevalence Rate, by County



Source: Fraym, Kenya DHS (2014, 2009, and 2003)

MAPPING PREVALENCE AND BURDEN || COUNTIES WITH LARGEST INCREASE/DECREASE

There were three counties with double-digit *increases* in under-18 prevalence between 2003 and 2014, while 8 other counties achieved double-digit *decreases*.[1]

Largest Percentage Point (pp) Increase in Under-18 Prevalence (2003 to 2014)	
Isiolo	+ 18 pp
Meru	+ 14 pp
Samburu	+ 13 pp
Laikipia	+ 9 pp
Bomet	+ 9 pp
Nyeri	+ 7 pp
Kirinyaga	+ 6 pp
Siaya	+ 6 pp
Nyamira	+ 5 pp
Kisii	+ 3 pp

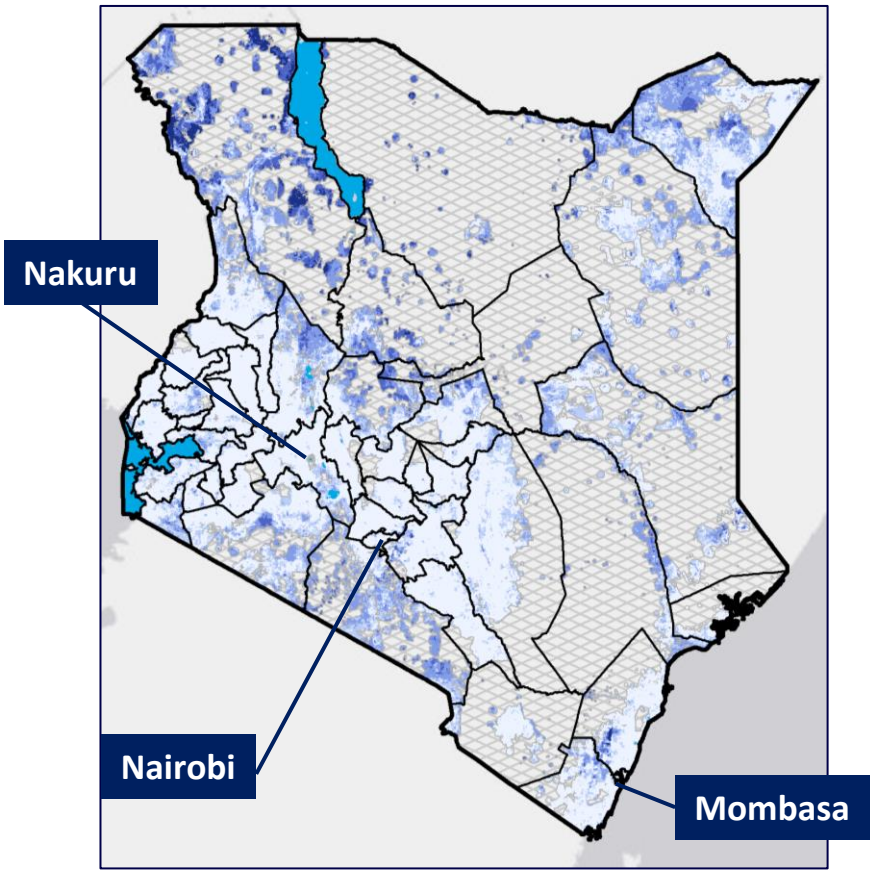
Largest Percentage Point (pp) Decrease in Under-18 Prevalence (2003 to 2014)	
West Pokot	- 14 pp
Wajir	- 14 pp
Kwale	- 13 pp
Kilifi	- 12 pp
Narok	- 12 pp
Taita Taveta	- 12 pp
Garissa	- 11 pp
Mandera	- 11 pp
Mombasa	- 9 pp
Makueni	- 8 pp

Note 1: Fraym calculated the percentage point (pp) difference between 2003 and 2014 to determine whether a county witnessed an increase or decrease in under-18 prevalence.
Source: Fraym, Kenya DHS (2014, 2003)

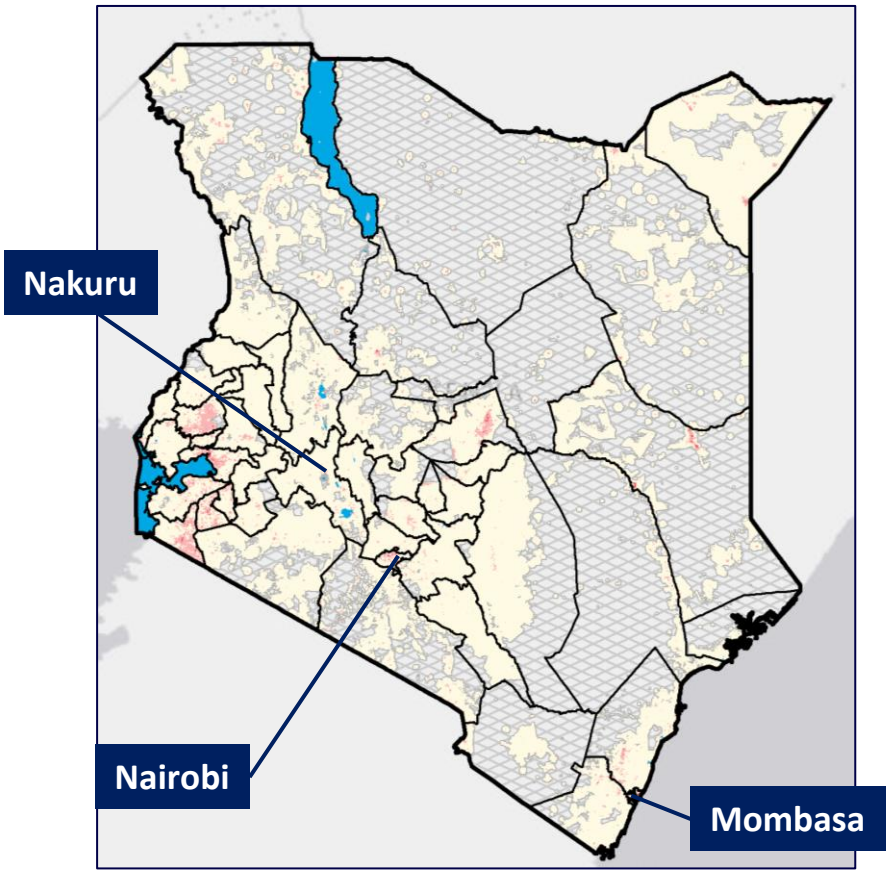
MAPPING PREVALENCE AND BURDEN || UNDER-15 (2014)

Child marriage before the age of 15 is primarily concentrated in northwest Kenya. With about 4 percent of women aged 20-24 married before age 15, the burden is lower and is concentrated in populated areas around Lake Victoria.

Under-15 Prevalence



Under-15 Burden



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

0% 50%+

Areas with total population less than 10 people per sq km

City Large cities

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

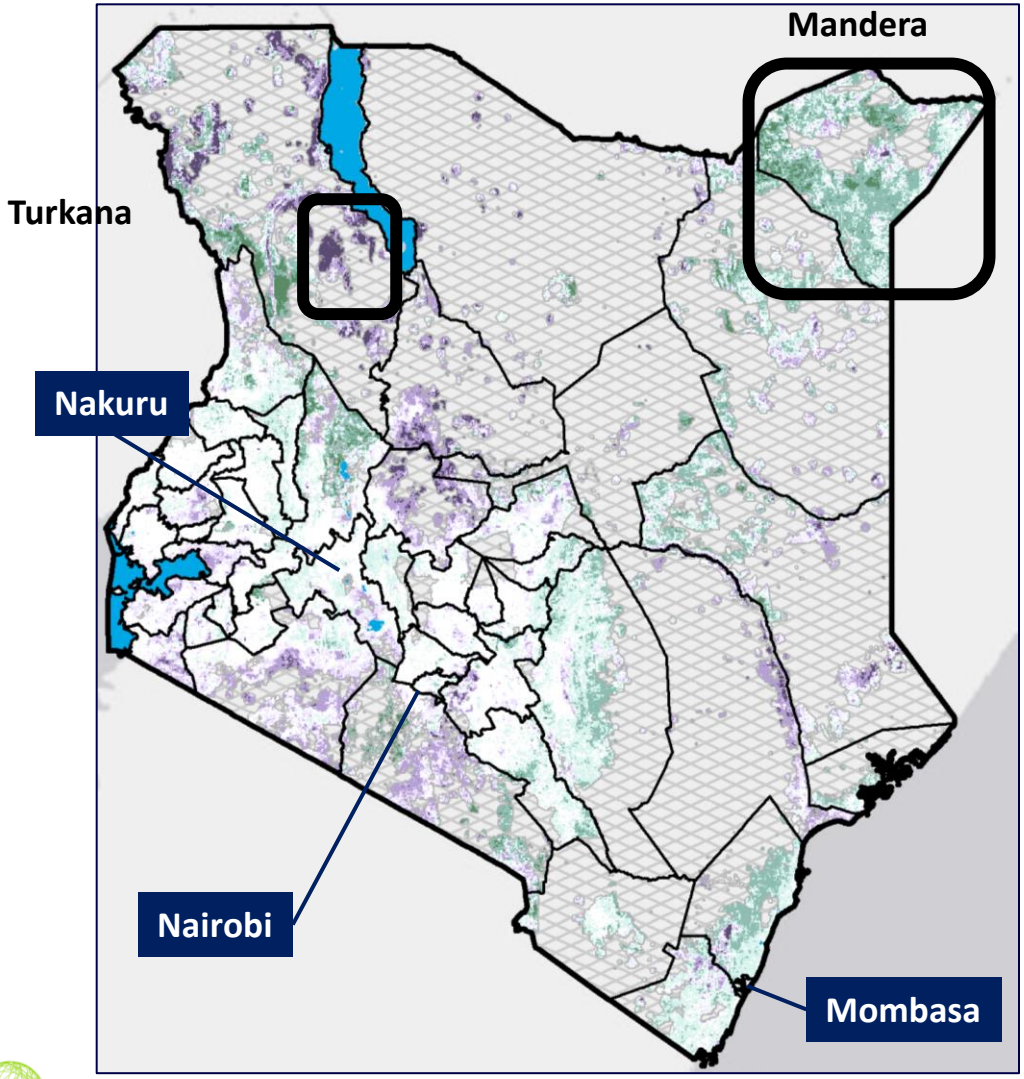
0 100+

Source: Fraym, Kenya DHS 2014, WorldPop 2014

MAPPING PREVALENCE AND BURDEN || UNDER-15 TIME SERIES (2003 to 2014)

Nationally, rates did not change substantially from 2003 to 2014 except for widespread decreases in Mandera county and notable pockets of increase in Turkana county.

Change in the Prevalence of Under 15 Child Marriage: 2003 to 2014



National Under-15 Prevalence

2003	2014
3.7%	3.8%

Percentage Point (pp) Change in Under 15 Prevalence from 2003 to 2014

- -25+ pp
- -25 pp to -10 pp
- -10 pp to -3 pp

Decrease

- -3 pp to 3 pp

- 3 pp to 10 pp
- 10 pp to 25 pp
- 25+ pp

Increase

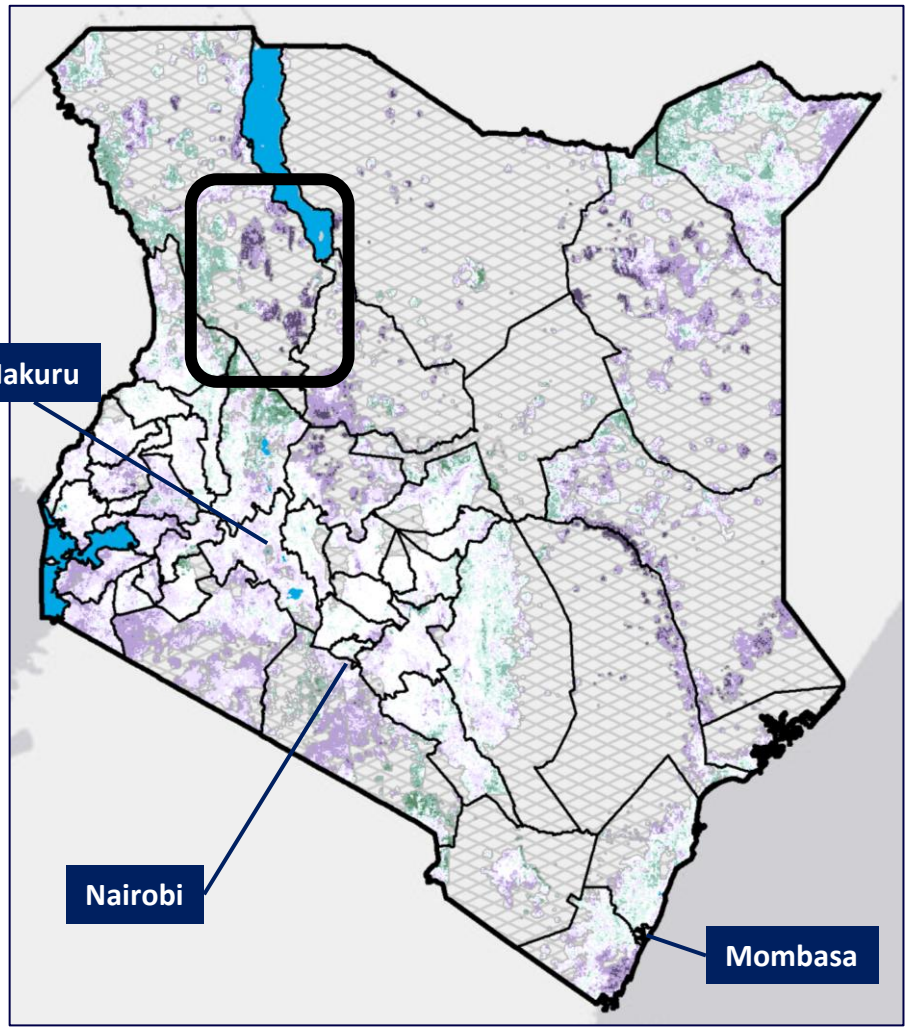
- Areas with total population less than 10 people per sq km
- Water bodies
- City Large cities

Source: Fraym, Kenya DHS 2014 and 2003

MAPPING PREVALENCE AND BURDEN || UNDER-15 TIME SERIES INTERVAL (2003 to 2009)

Much of Kenya saw under-15 prevalence rates increase or stay constant between 2003 and 2009.

Change in the Prevalence of Under-15 Child Marriage: 2003 to 2009



National Under-15 Prevalence

2003	2009
3.7%	5.3%

Percentage Point (pp) Change in Under-15 Prevalence from 2003 to 2009

- -25+ pp
- -25 pp to -10 pp
- -10 pp to -3 pp

Decrease

- -3 pp to 3 pp
- 3 pp to 10 pp
- 10 pp to 25 pp
- 25+ pp

Increase

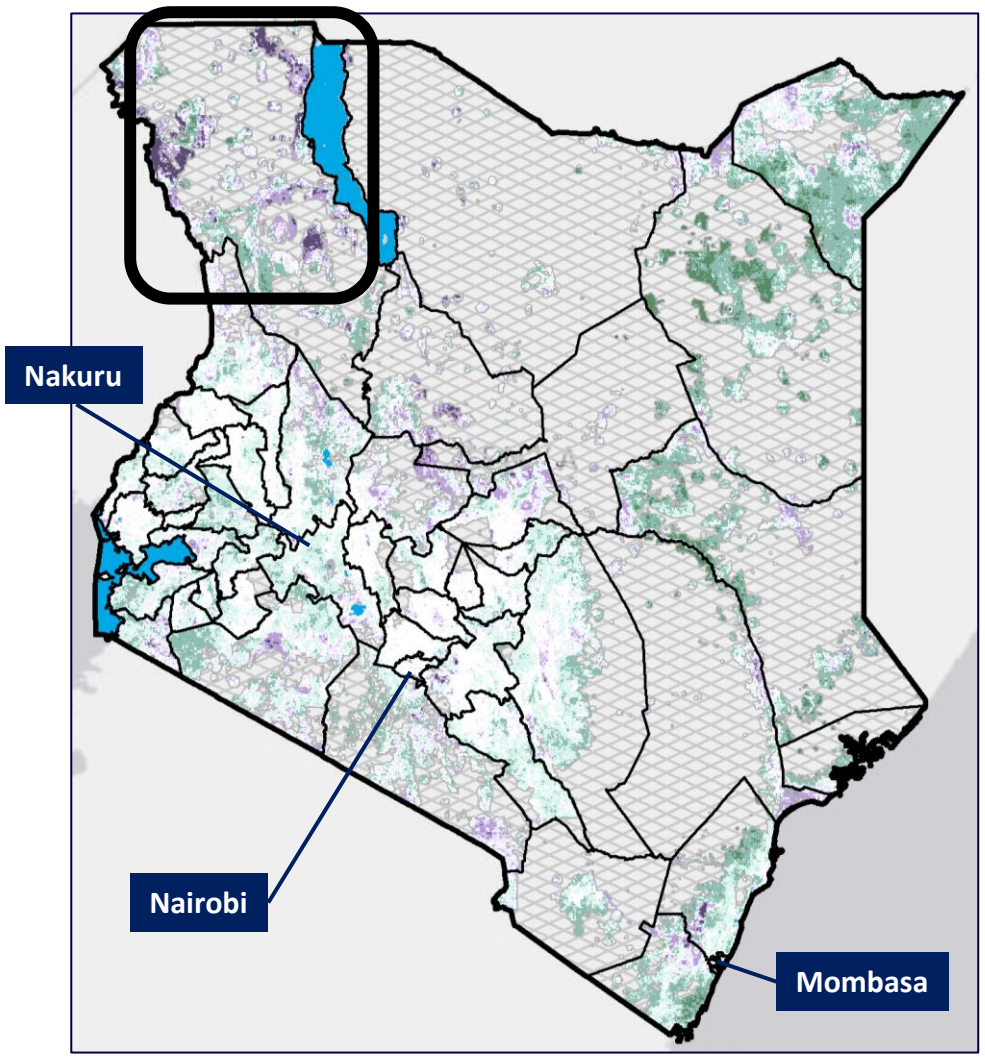
- Areas with total population less than 10 people per sq km
- Water bodies
- City — Large cities

Source: Fraym, Kenya DHS 2009 and 2003

MAPPING PREVALENCE AND BURDEN || UNDER-15 TIME SERIES INTERVAL (2009 to 2014)

The prevalence of under-15 child marriage subsequently declined or held steady between 2009 and 2014, apart from some areas in Turkana county.

Change in the Prevalence of Under-15 Child Marriage: 2009 to 2014



National Under-15 Prevalence

2009	2014
5.3%	3.8%

Percentage Point (pp) Change in Under-15 Prevalence from 2009 to 2014

- -25+ pp
- -25 pp to -10 pp
- -10 pp to -3 pp

Decrease

- -3 pp to 3 pp

- 3 pp to 10 pp
- 10 pp to 25 pp
- 25+ pp

Increase

Areas with total population less than 10 people per sq km

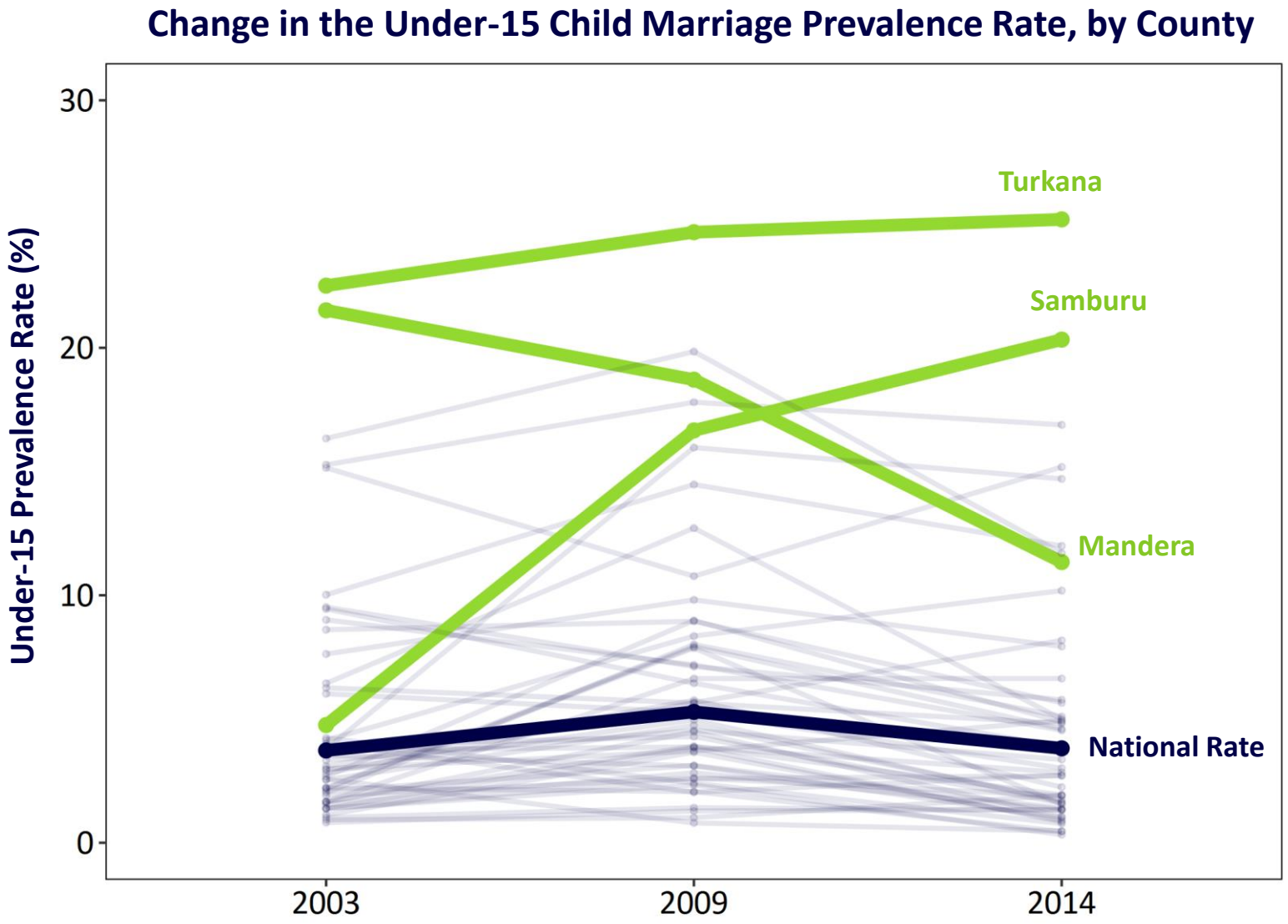
Water bodies

City Large cities

fraym

Source: Fraym, Kenya DHS 2014 and 2009

Turkana county retained the highest under-15 prevalence rates, while prevalence increased rapidly for Samburu county. Mandera county, on the other hand, achieved a steady decline between 2003 and 2014.



Source: Fraym, Kenya DHS (2014, 2009, and 2003)

MAPPING PREVALENCE AND BURDEN || COUNTIES WITH LARGEST INCREASE/DECREASE

There were 15 counties with *increases* in under-15 prevalence between 2003 and 2014, while 24 other counties achieved *decreases*.[1]

Largest Percentage Point (pp) Increase in Under-15 Prevalence (2003 to 2014)	
Samburu	+ 16 pp
Tana River	+ 11 pp
Migori	+ 6 pp
Laikipia	+ 5 pp
Kisumu	+ 5 pp
Homa Bay	+ 3 pp
Turkana	+ 3 pp
Kakamega	+ 2 pp
Narok	+ 2 pp
Garissa	+ 2 pp

Largest Percentage Point (pp) Decrease in Under-15 Prevalence (2003 to 2014)	
Mandera	- 10 pp
Taita Taveta	- 6 pp
Wajir	- 5 pp
Kilifi	- 4 pp
Baringo	- 4 pp
Elgeyo-Marakwet	- 3 pp
Kitui	- 3 pp
Lamu	- 3 pp
Nyandarua	- 3 pp
Makueni	- 2 pp

Note 1: Fraym calculated the percentage point (pp) difference between 2003 and 2014 to determine whether a county witnessed an increase or decrease in under-15 prevalence.
Source: Fraym, Kenya DHS (2014, 2003)

MAPPING PREVALENCE AND BURDEN || KEY TAKEAWAYS

National rates did not change substantially over time, but sub-national variation suggests that high prevalence areas may be shifting from one community to another.

1. In 2014, the national under-18 prevalence rate was 25 percent. An estimated 495,000 women (aged 20-24) were married before age 18.

2. **From 2003 to 2014, the under-18 prevalence rate changed little from 26 percent to 25 percent.** However, at a sub-national level, 60 percent of counties saw a decrease in under-18 prevalence between 2003 and 2014.

3. Nationally, the under-15 prevalence rate was 4 percent in 2014. An estimated 76,000 women (aged 20-24) were married before age 15.

4. **The under-15 prevalence rate at the national level has held steady from 2003 to 2014 (4 percent).** However, some counties witnessed notable changes, such as Samburu (rapid *increase*) and Mandera (rapid *decrease*).

5. Wajir county experienced notable improvements: the second largest decrease in under-18 prevalence and the third largest decrease in under-15 prevalence. Samburu county witnessed the third largest increase in under-18 prevalence and largest increase in under-15 prevalence from 2003 to 2014.

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** such as employment and education, as well as 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 sub-county level**. The analysis assesses the relationship visually and with the calculation of the correlation coefficient. [2]

Note 1: For the remainder of this report, child marriage prevalence refers to under-18 prevalence unless otherwise noted.
Note 2: Analyses are bivariate and thus do not control for other factors.

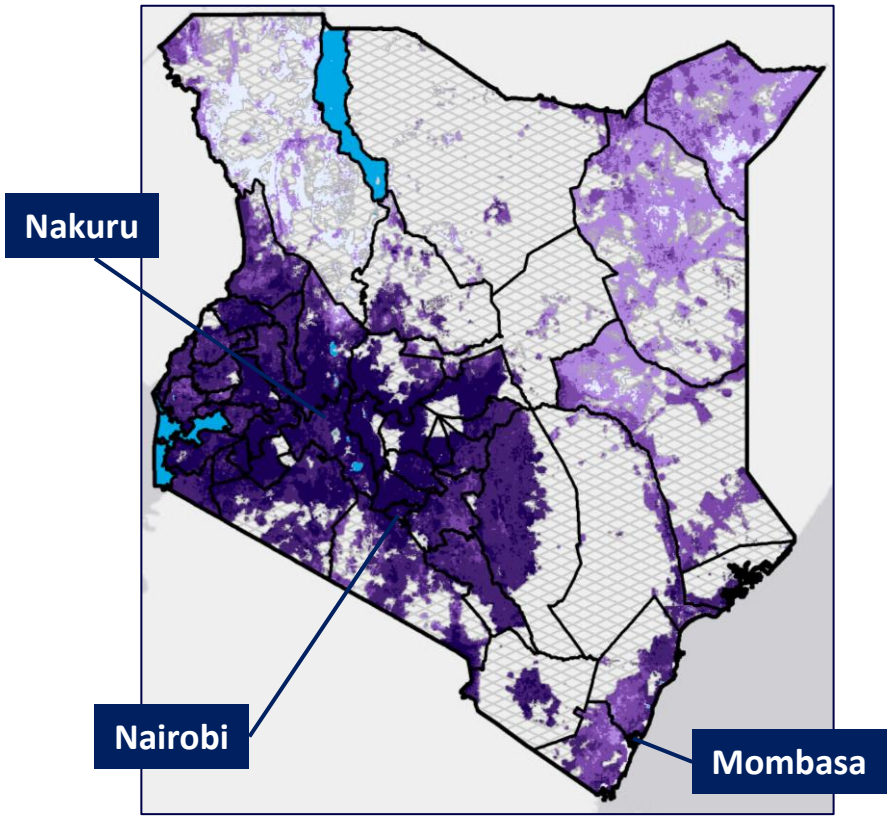
Fraym mapped a variety of community characteristics, then analyzed the statistical relationship with child marriage prevalence at the sub-county level.[1]

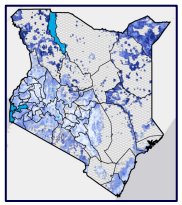
Socioeconomic Characteristics	
Adult Employment Adult Female Employment Educational Attainment by Sex	*Expected Relationship* = Areas with higher employment or educational attainment may have lower rates of child marriage prevalence.
Sexual and Reproductive Health	
Modern Contraceptive Prevalence	*Expected 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. The expected relationship is a hypothesis based on expert consultation and a review of the existing literature.
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

Sub-counties with high prevalence rates also have low rates of adult employment.

Adult Employment at the Community Level





Percent of adults (aged 15-49) that are employed

0% 70%+

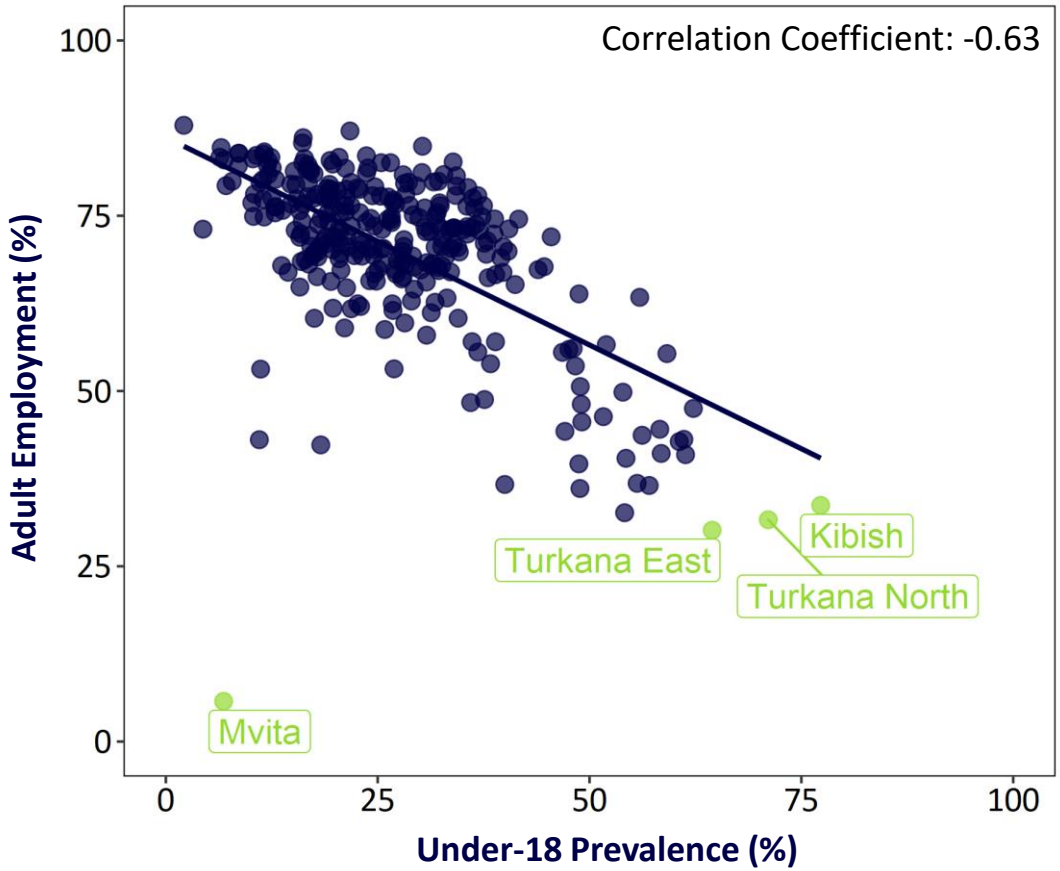
Under 18 Prevalence

Areas with total population less than 10 people per sq km

City Large cities

Adult Employment Rate and Child Marriage Prevalence

Each point represents a sub-county.

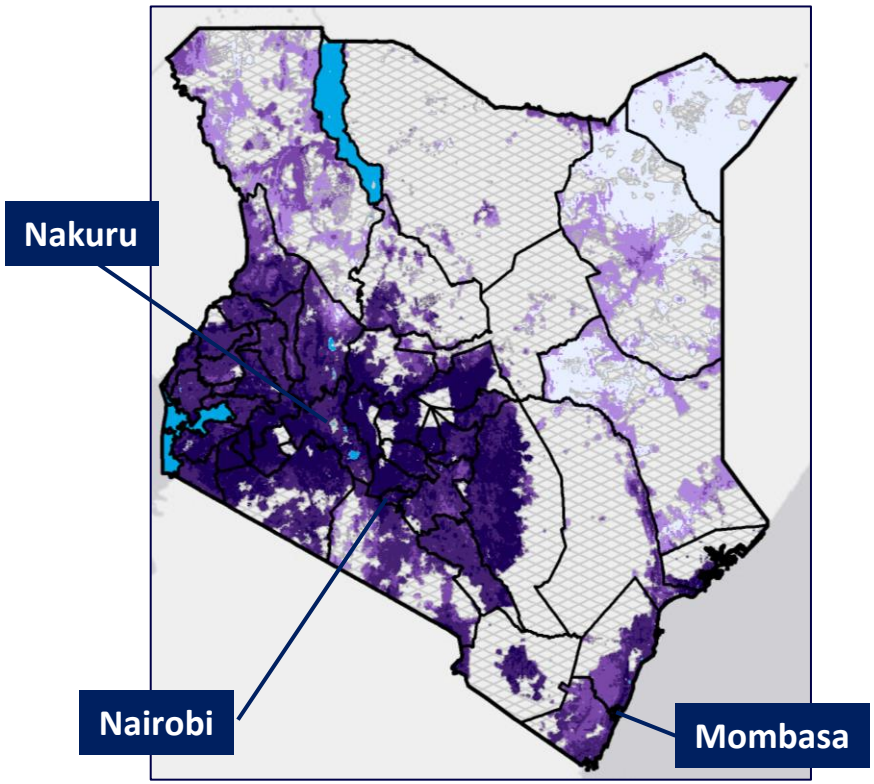


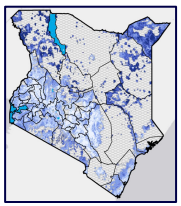
Source: Fraym, Kenya DHS 2014

COMMUNITY CHARACTERISTICS || ADULT FEMALE EMPLOYMENT

Similar to overall employment, female employment is negatively associated with child marriage prevalence.

Adult Female Employment at the Community Level





Percent of women (aged 15-49) that are employed

0% 60%+

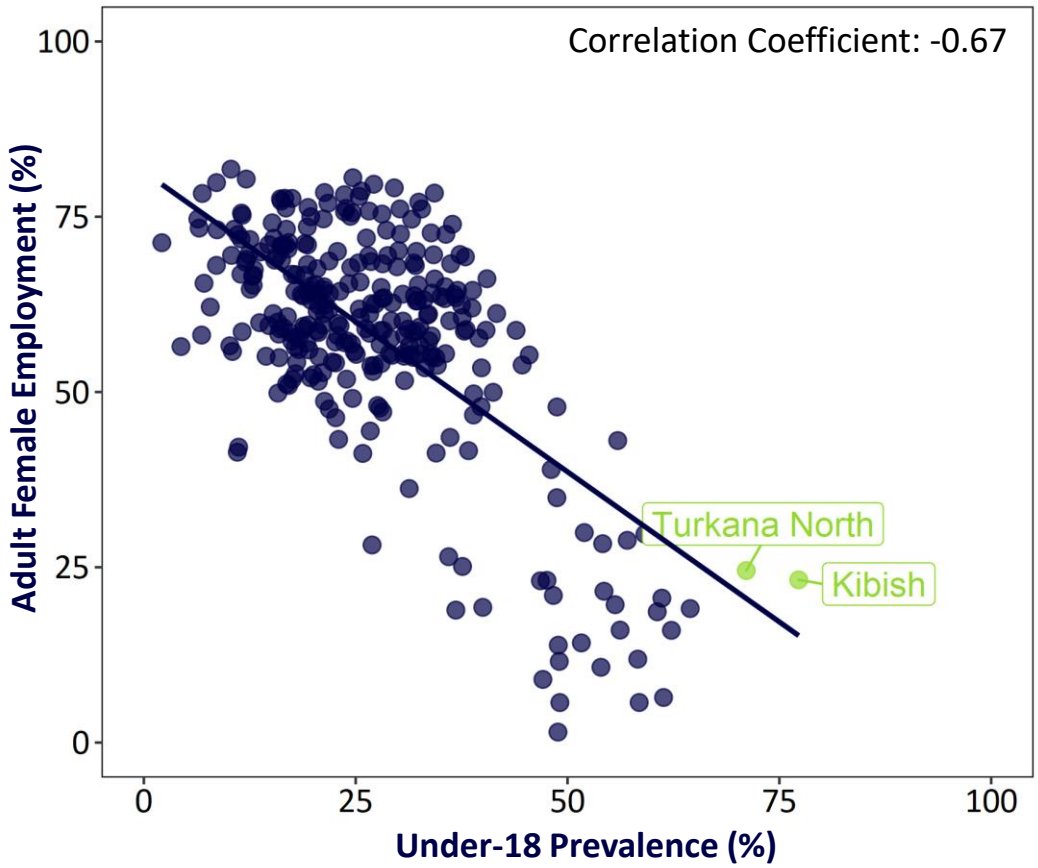
Under 18 Prevalence

Areas with total population less than 10 people per sq km

City Large cities

Adult Female Employment Rate and Child Marriage Prevalence

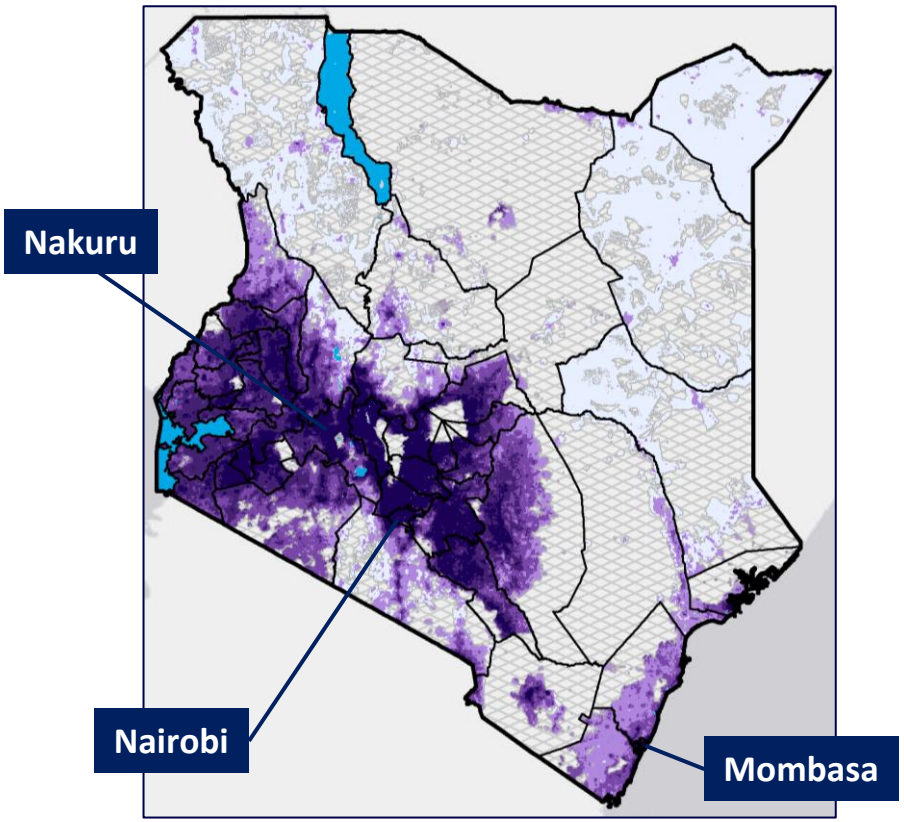
Each point represents a sub-county.

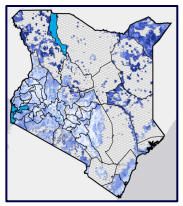


fraym **Source:** Fraym, Kenya DHS 2014

Sub-counties with high prevalence rates have low rates of female educational attainment. This relationship, captured by the correlation coefficient, is strong.

Female Educational Attainment at the Community Level





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

0% 65%+

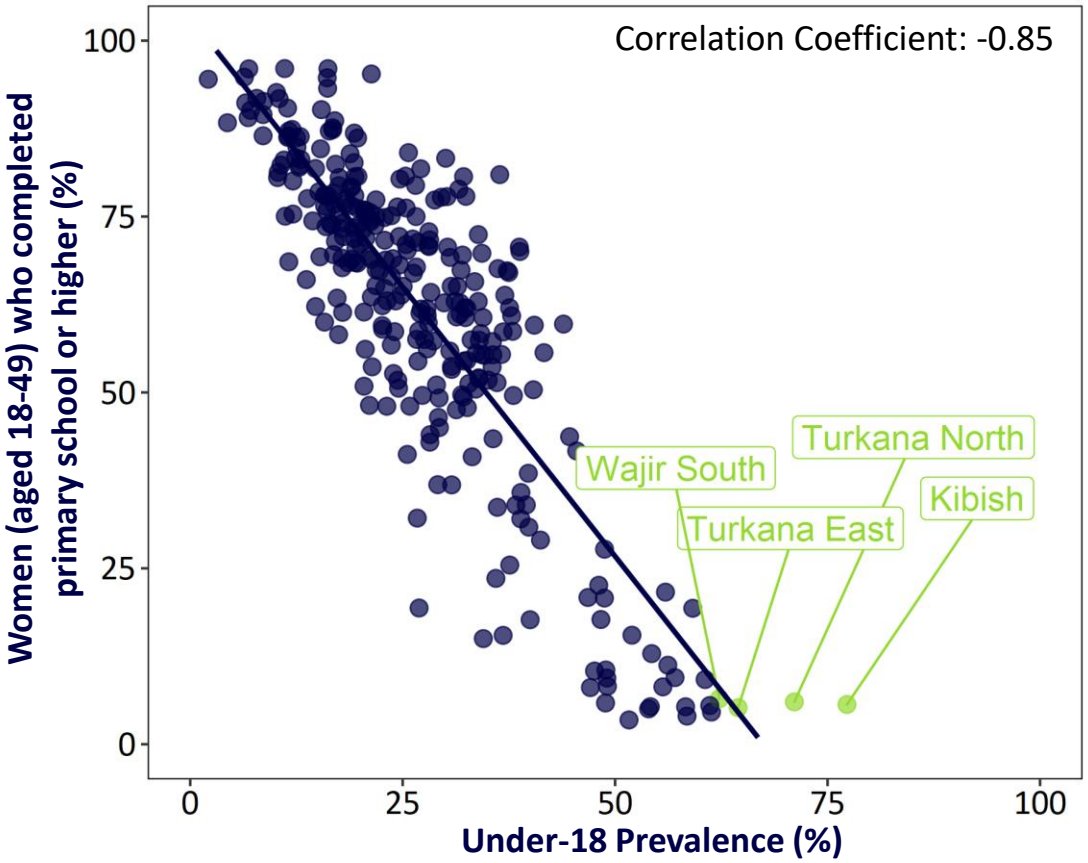
Under 18 Prevalence

Areas with total population less than 10 people per sq km

City Large cities

Female Educational Attainment and Child Marriage Prevalence

Each point represents a sub-county.

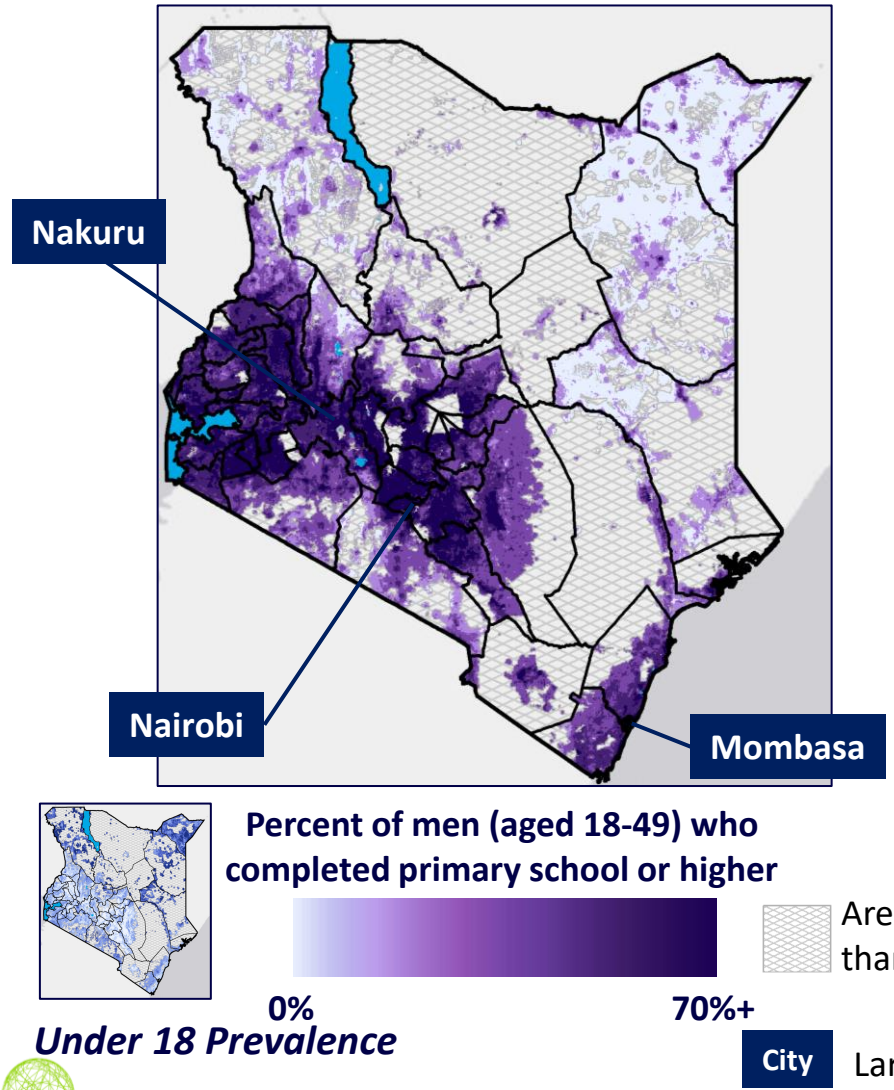


fraym

Source: Fraym, Kenya DHS 2014

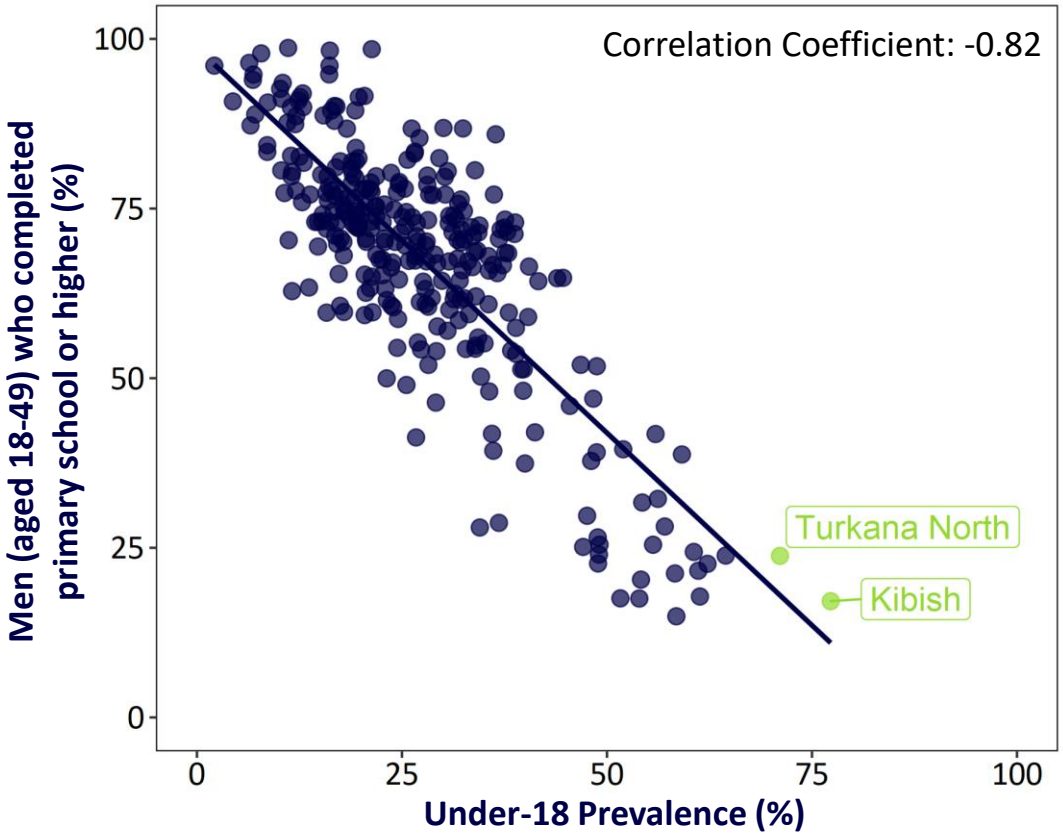
Similarly, sub-counties with high prevalence have low rates of male educational attainment. This relationship, captured by the correlation coefficient, is strong.

Male Educational Attainment at the Community Level



Male Educational Attainment and Child Marriage Prevalence

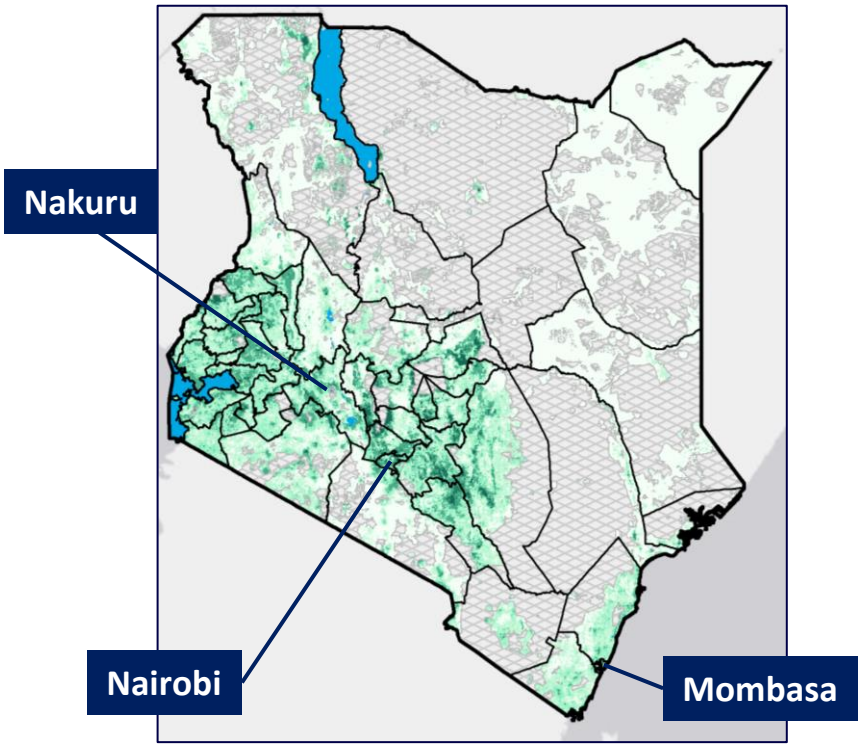
Each point represents a sub-county.



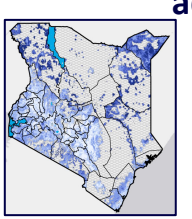
Source: Fraym, Kenya DHS 2014

Sub-counties with higher rates of modern contraceptive use among women aged 15-24 tend to have lower rates of child marriage prevalence.[1]

Modern Contraceptive Use at the Community Level



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



Under 18 Prevalence

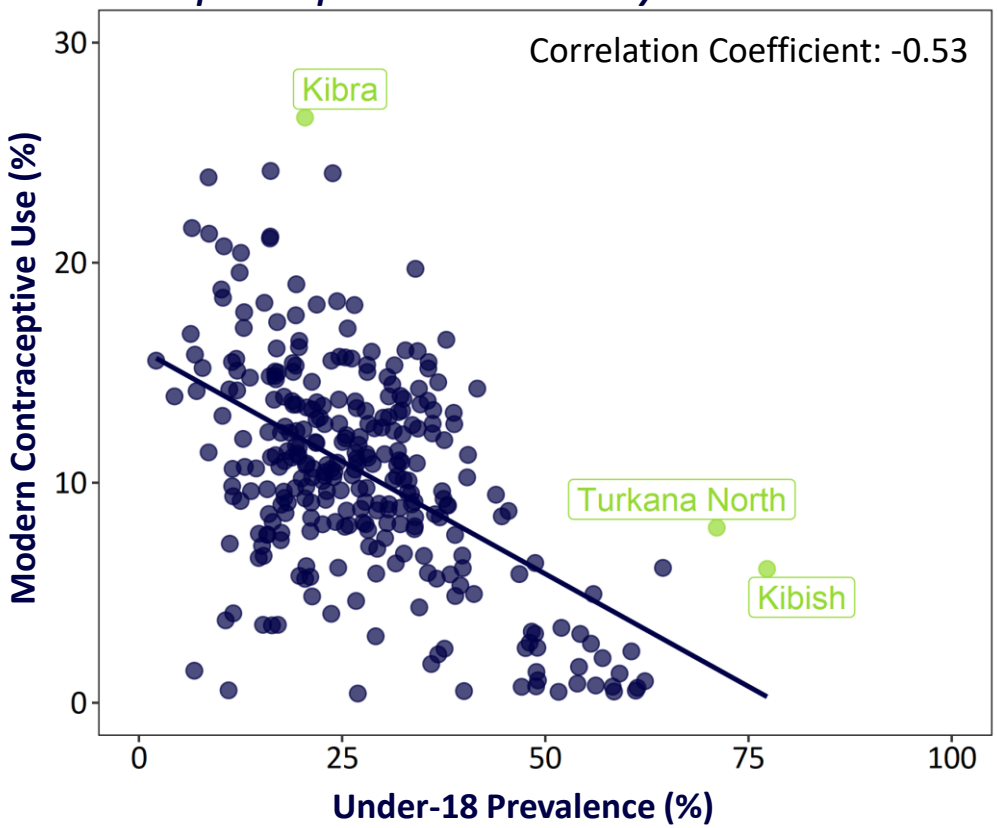
0% — **20%+**

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 sub-county.



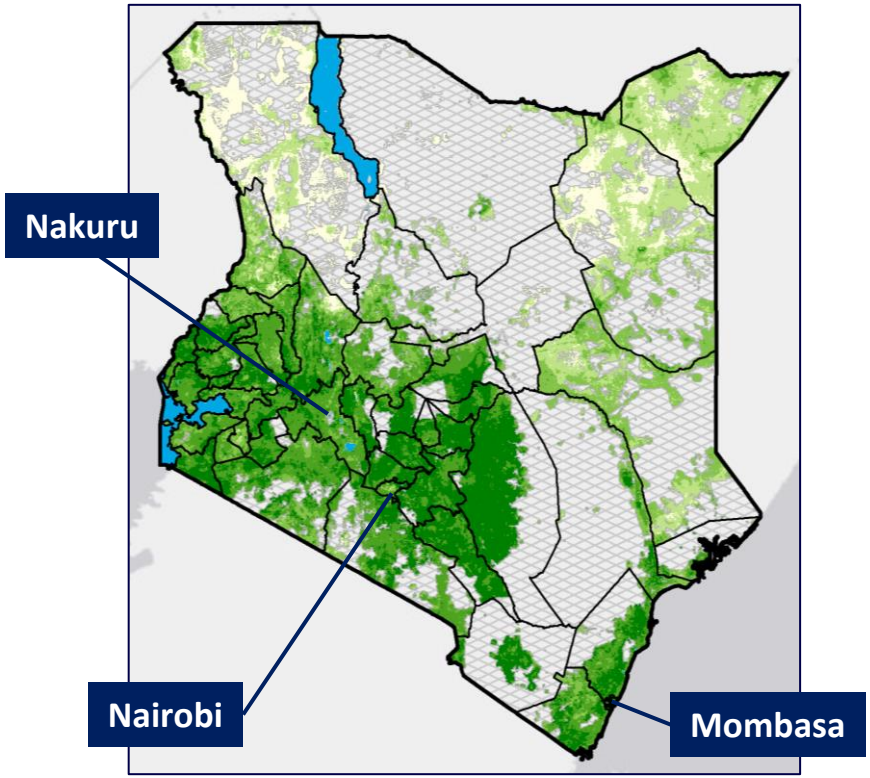
The y-axis intervals vary across indicators depending on the range of the values.

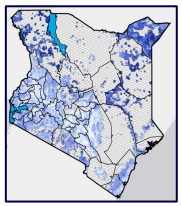
Note 1: Modern contraceptive prevalence is defined using the DHS definition, that is the percent of women (aged 15-49) that use a modern method. Modern methods exclude periodic abstinence and withdrawal, which are considered traditional methods.

Source: Fraym, Kenya DHS 2014

Sub-counties with high rates of child marriage prevalence also have low rates of women who use the health system.[1]

Health System Usage at the Community Level





Under 18 Prevalence

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

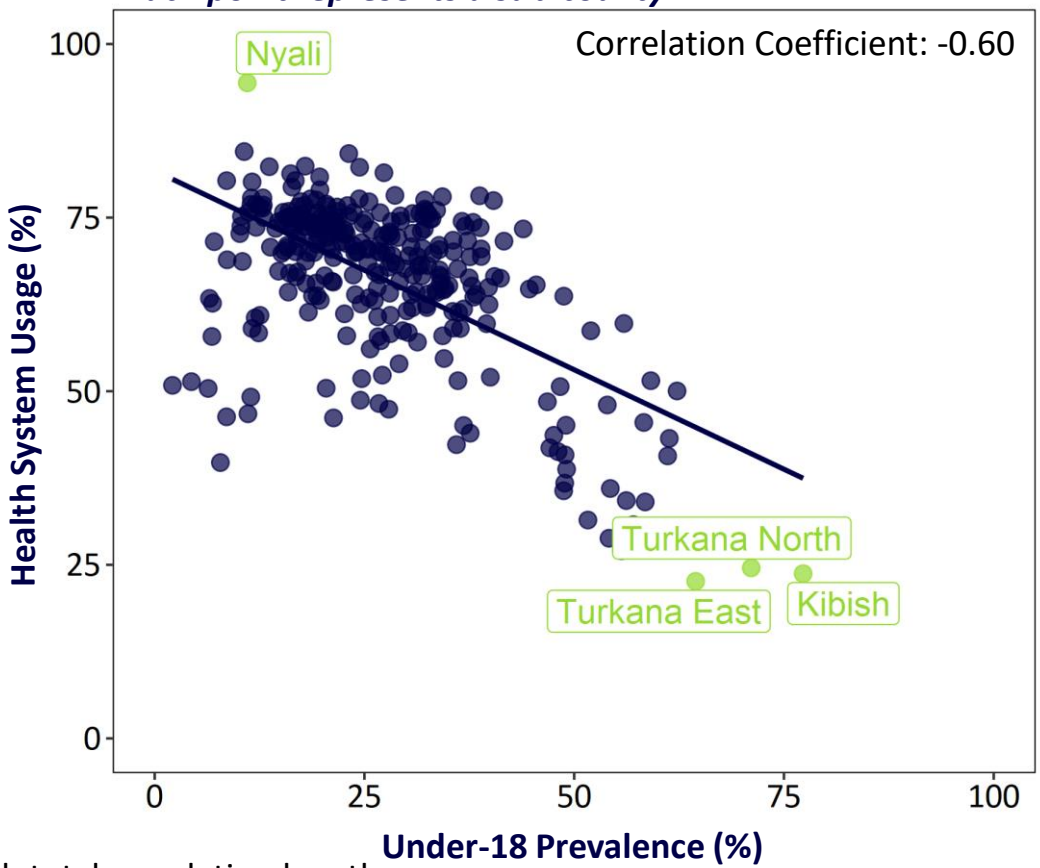
0% — **65%+**

Areas with total population less than 10 people per sq km

City Large cities

Health System Usage and Child Marriage Prevalence

Each point represents a sub-county.

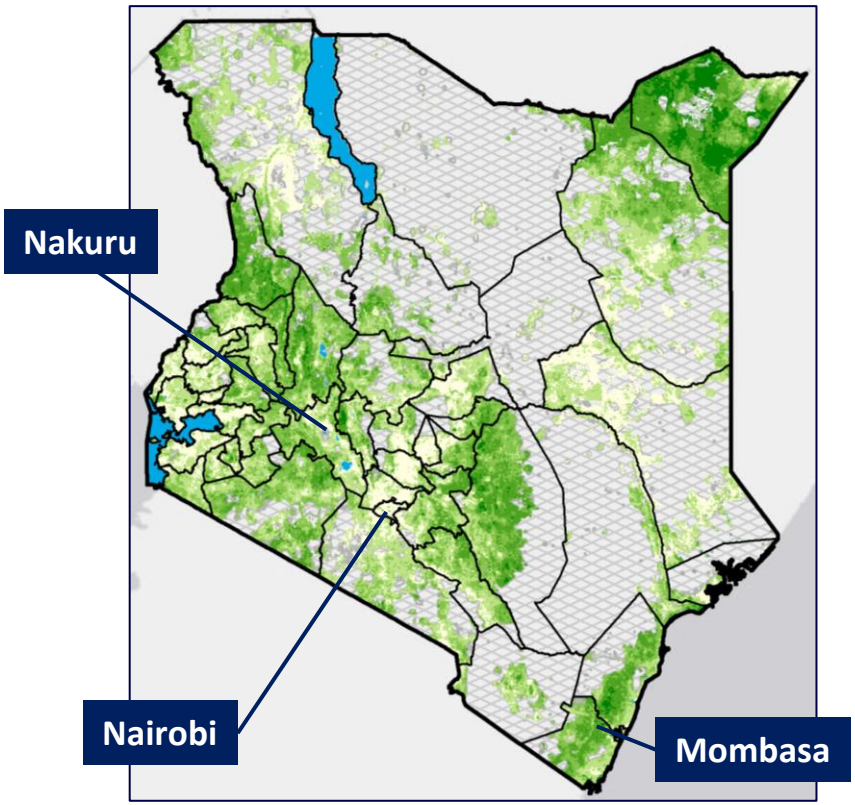


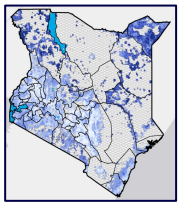
Note 1: Health system usage is defined as women (ages 15-49) who have visited a health facility or have been visited by a fieldworker to talk about family planning in the past 12 months.

Source: Fraym, Kenya DHS 2014

The relationship between child marriage prevalence and child stunting is weak. Sub-counties with high stunting rates do not necessarily have high prevalence rates.

Child Stunting at the Community Level





Percent of children under five who are stunted

0% 40%+

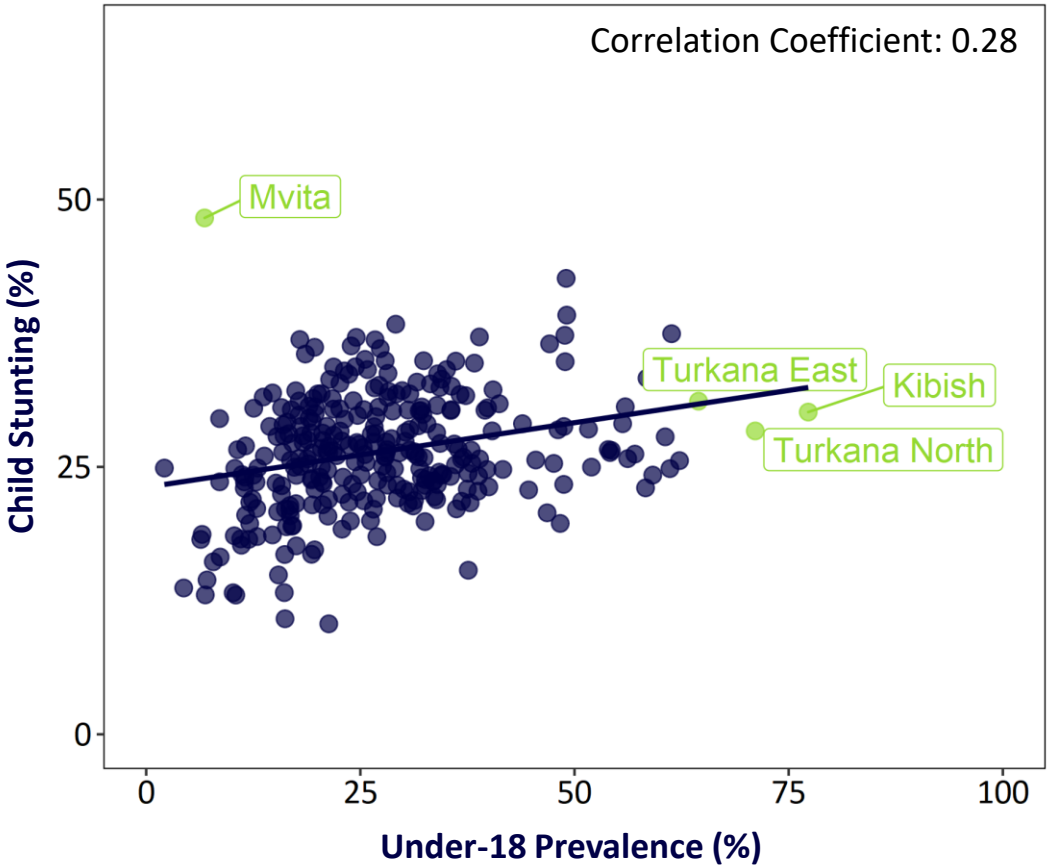
Under 18 Prevalence

City Large cities

Areas with total population less than 10 people per sq km

Child Stunting and Child Marriage Prevalence

Each point represents a sub-county.

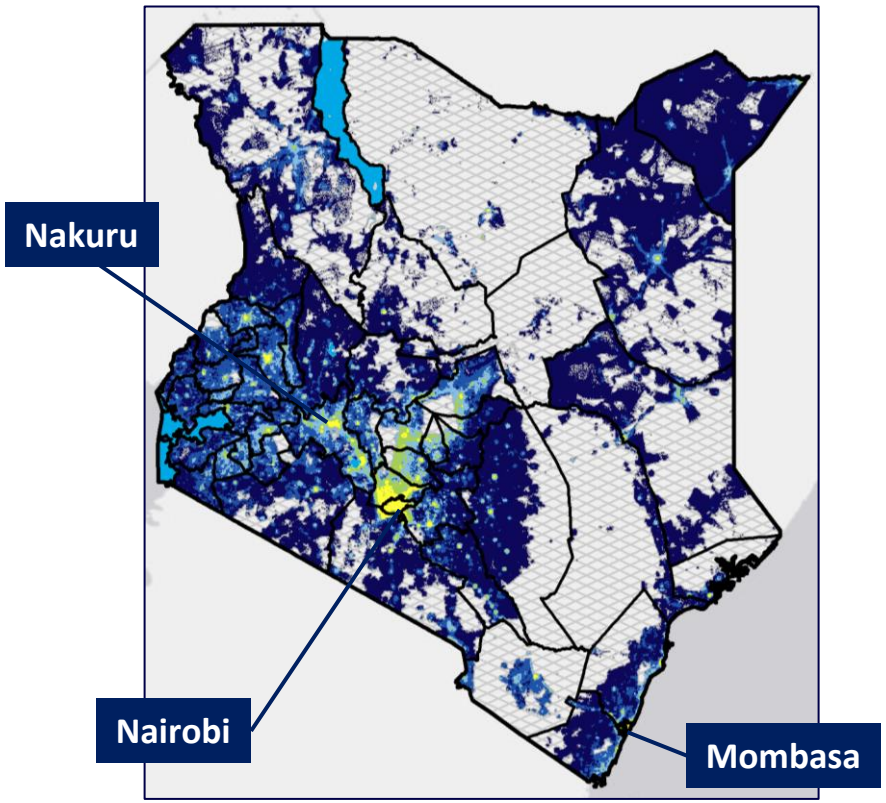


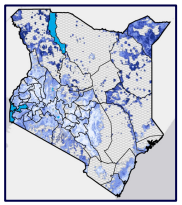
The y-axis intervals vary across indicators depending on the range of the values.

Source: Fraym, Kenya DHS 2014

Sub-counties with high child marriage prevalence tend to have low rates of access to electricity.

Access to Electricity at the Community Level





Under 18 Prevalence

Percent of individuals that live in a household with access to electricity

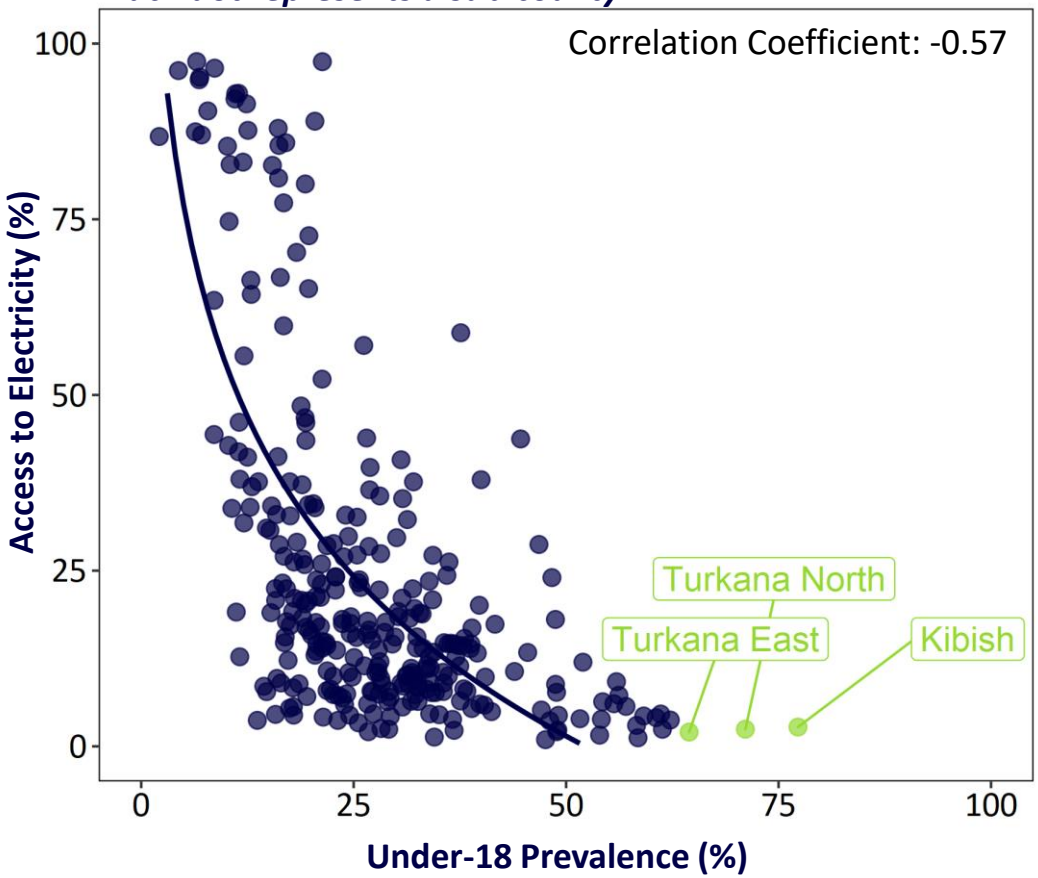
0% **60%+**

Areas with total population less than 10 people per sq km

City Large cities

Access to Electricity and Child Marriage Prevalence

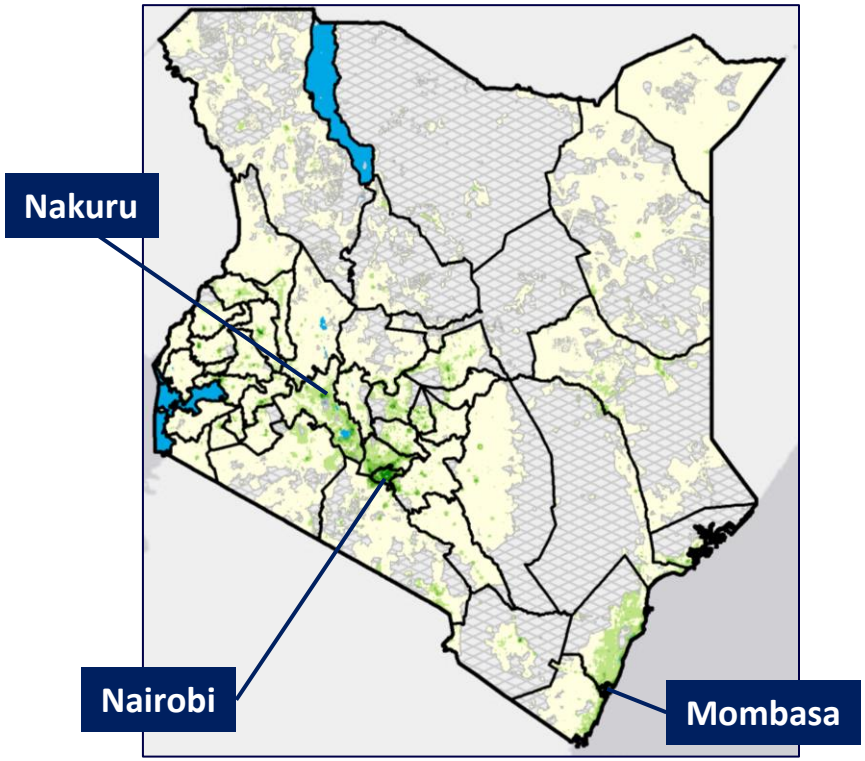
Each dot represents a sub-county.

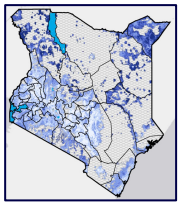


Source: Fraym, Kenya DHS 2014

Sub-counties with the highest prevalence areas have very limited access to improved sanitation.

Flush Toilet Access at the Community Level





Under 18 Prevalence

Percent of individuals that live in a household with a flush toilet

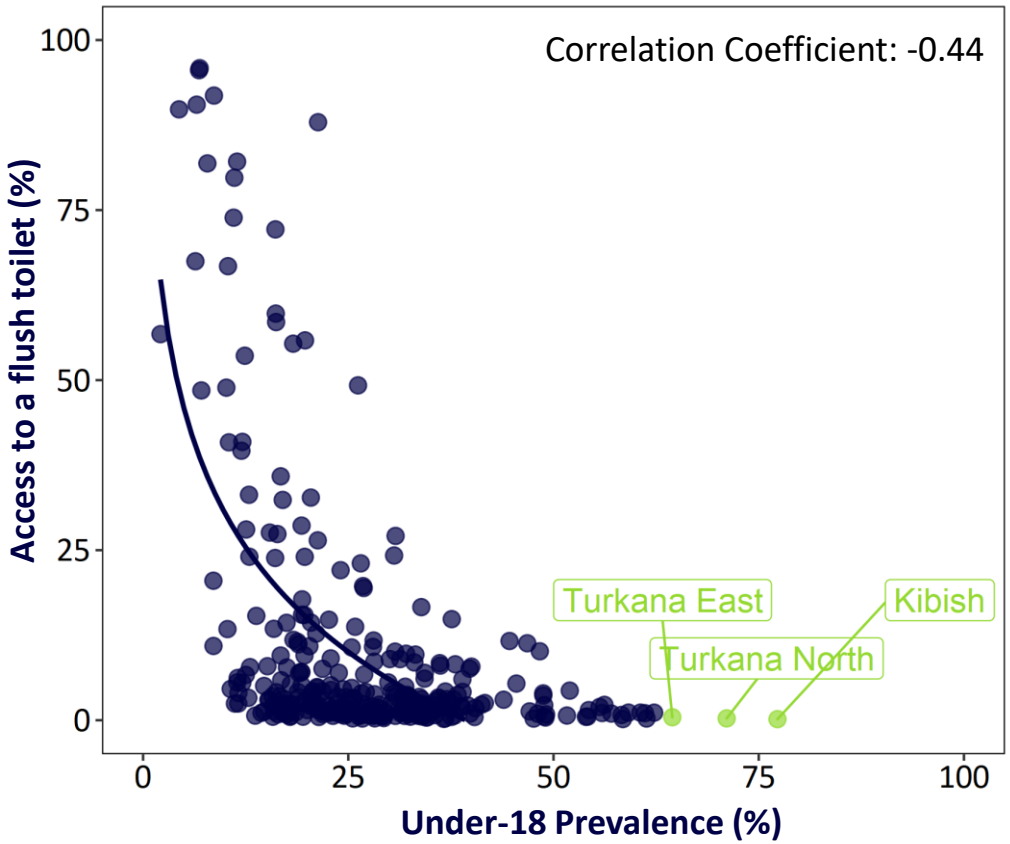
0% — **55%+**

Areas with total population less than 10 people per sq km

City Large cities

Flush Toilet Access and Child Marriage Prevalence

Each dot represents a sub-county.



Source: Fraym, Kenya DHS 2014

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 **child stunting and under-18 prevalence is the smallest magnitude across the examined characteristics**. Child marriage and stunting are likely related through early childbearing.

3. Indicators that are **not traditionally considered in the child marriage literature, such as access to electricity, have a strong negative relationship** with under-18 prevalence.

Correlation Coefficient with Child Marriage Prevalence at the Sub-County Level	
Socioeconomic Characteristics	
Adult Employment	-0.63
Female Employment	-0.67
Female Educational Attainment	-0.85
Male Educational Attainment	-0.82
Health	
Modern Contraceptive Use	-0.53
Health System Usage	0.60
Child Stunting	0.28
Infrastructure	
Access to Electricity	-0.57
Flush Toilet Access	-0.44

fraym

Source: Fraym

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 Kenya.

2. Fraym then **estimated the potential risk factors 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.

AT-RISK POPULATION || PREGNANCY & CHILD MARRIAGE (ANALYTIC FRAMEWORK)

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 Kenya is relatively high – 39 percent of women aged 15 to 24 have given birth, regardless of marital status.

2. In Kenya, only 13 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	68%	15%	39%
Ever-married women[1]	90%	66%	85%
Never-married women	29%	6%	13%

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 were identical, except for the 15-19 age group, where the proportion was 65 percent.
Source: Fraym, Kenya DHS 2014

AT-RISK POPULATION || PREGNANCY & CHILD MARRIAGE (NATIONAL CONTEXT)

Among women who were married as children, nearly a quarter gave birth either before or within six months of marriage.

1. One-third of ever-married women aged 15 to 24 gave birth before or within six months of marriage. These figures indicate that a sizeable portion of women became pregnant outside of marriage and then were married.

2. Additionally, 24 percent of women aged 20-24 who were married before age 18 gave birth before or within six months of marriage, which suggests pregnancy outside of marriage is a strong risk factor for child marriage in Kenya.

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	22%	4%	12%
Ever-married women[1]	34%	28%	33%
Women who were married before age 18	24%	-	-

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 were identical, except for the 15-19 age group, where the proportion was 29 percent.
Source: Fraym, Kenya DHS 2014

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

Fraym's risk profile focuses on pregnancy outside of marriage, which includes either before or up until six months after marriage.

1. When considering a pregnancy profile measure, Fraym examined a range of possible approaches based upon the correlations between pregnancy and birth, sexual activity, and use of contraception indicators.

2. Based on expert feedback and analysis, Fraym focused on a single indicator – **the proportion of women aged 15 to 24 who experienced a pregnancy outside of marriage, which is defined as giving birth anytime before marriage or up until six months after marriage.**[1]

3. Fraym then **estimated 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 pregnancy outside of marriage are categorized as a 4 ("high risk").

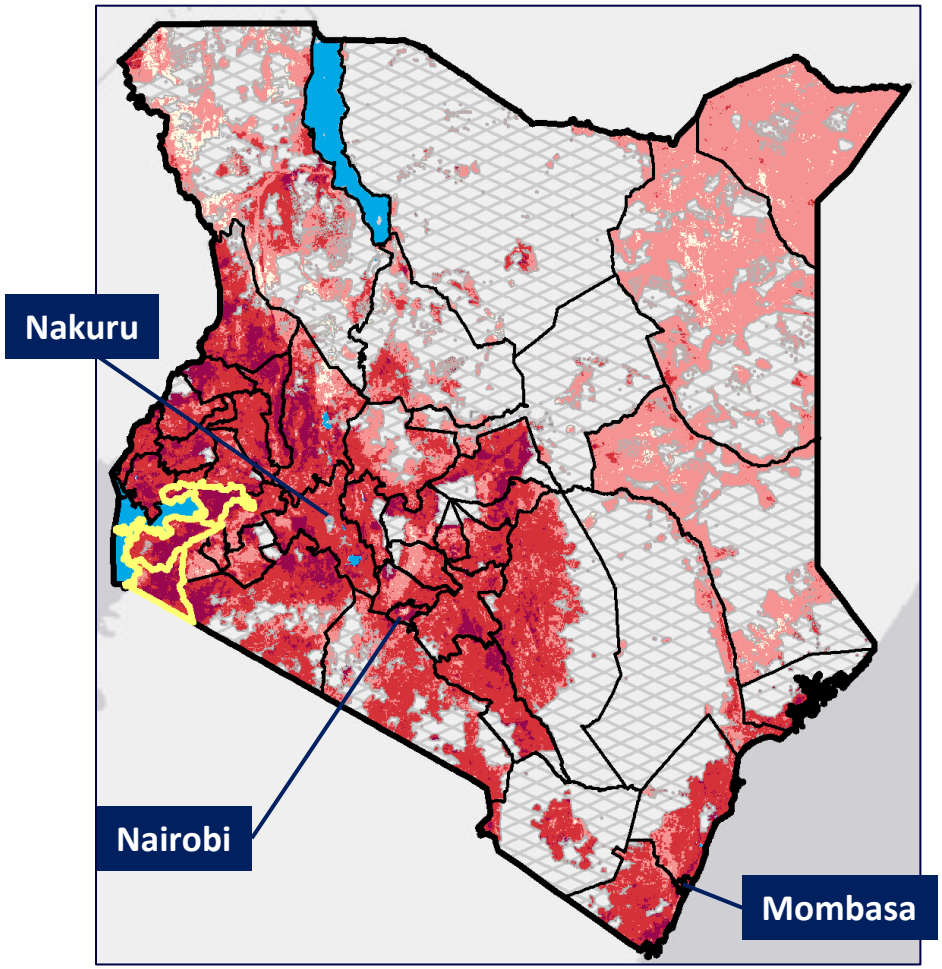
4. Finally, Fraym **estimated the number of at-risk girls** by calculating the total number of girls aged 10 to 14 who live in the communities where pregnancy outside of marriage represents the highest risk for child marriage (categorized as a 4).

Note 1: By definition, a women who experienced pregnancy outside of marriage is ever-married. Therefore, never-married women who gave birth are not considered to have experienced a pregnancy outside of marriage.

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

There are an estimated 554,000 girls aged 10 to 14 who live in communities where pregnancy outside of marriage represents a high risk for child marriage.

Pregnancy Outside of Marriage Risk Category[1]



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

Population of at-risk girls due to pregnancy outside of marriage, highlighted counties[2]

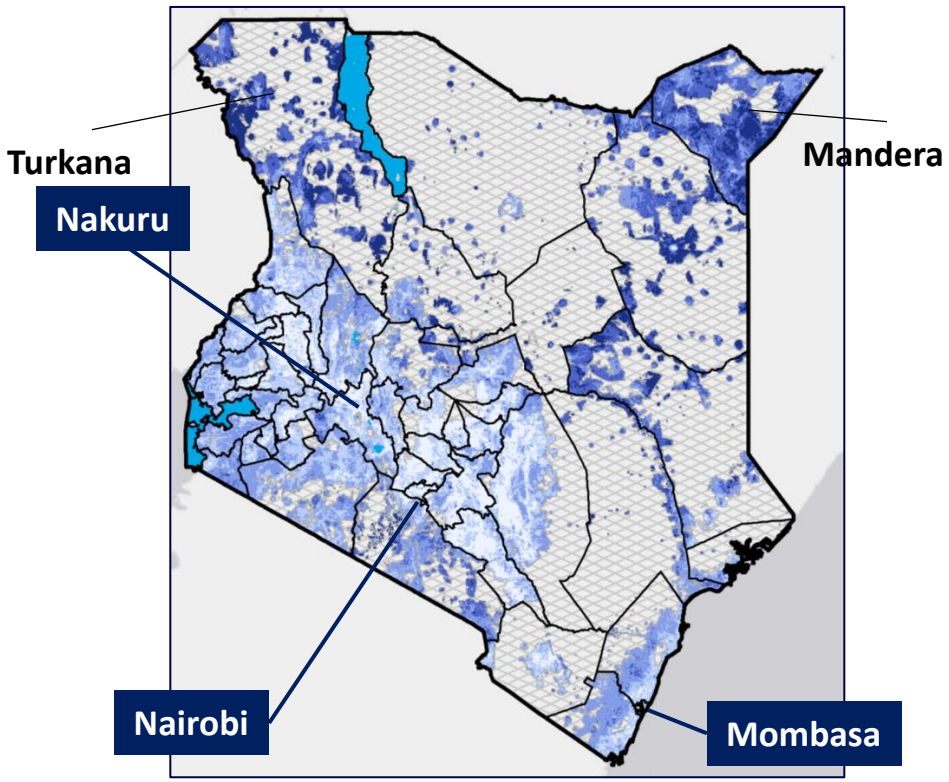
County	Population of at-risk girls (aged 10-14)
Kisumu	58,500
Migori	37,300
Homa Bay	38,000

Note 1: The map shows the classification of pregnancy outside of marriage for each 1km^2 cell into quartiles. The pregnancy outside of marriage risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. See slide 42 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 pregnancy outside of marriage risk category equal to 4 (highest risk).
Source: Fraym, Kenya DHS 2014, Worldpop 2020

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

High child marriage prevalence areas are not necessarily areas with high concentrations of pregnancy outside of marriage, such as with Mandera and Turkana counties.

Child Marriage Prevalence



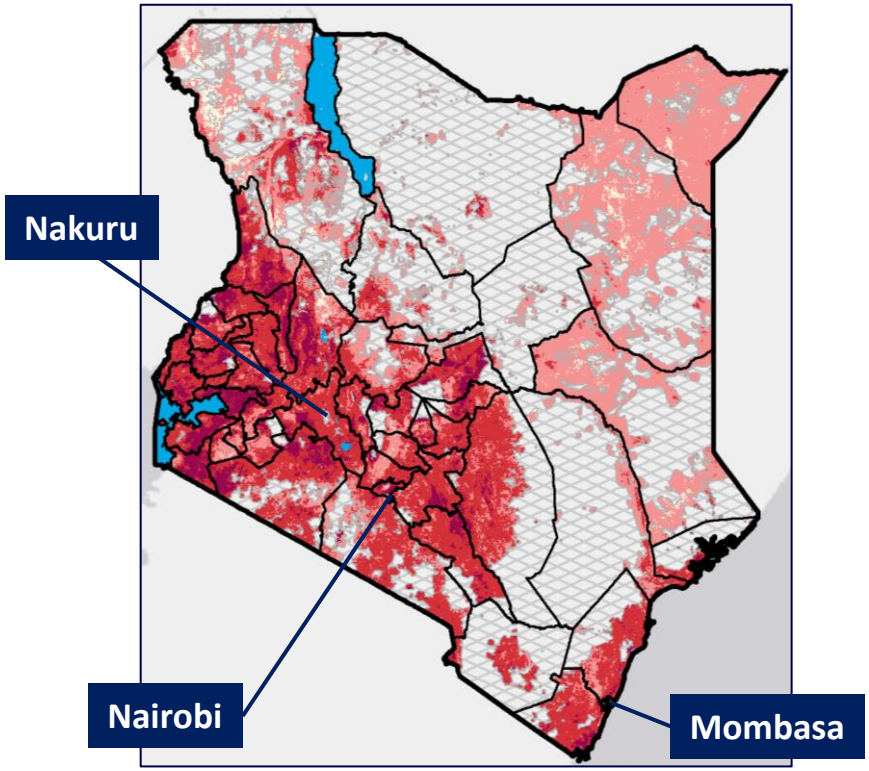
Percent of women (aged 20-24) who were married before 18

0% 60%+

Areas with total population less than 10 people per sq km

City Large cities

Pregnancy Outside of Marriage Risk Category[1]



Low Risk
Medium-Low Risk
Medium-High Risk
High Risk

Note 1: The map shows the classification of pregnancy outside of marriage for each 1km^2 cell into quartiles. The pregnancy outside of marriage risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. See slide 42 or the appendix for more details.

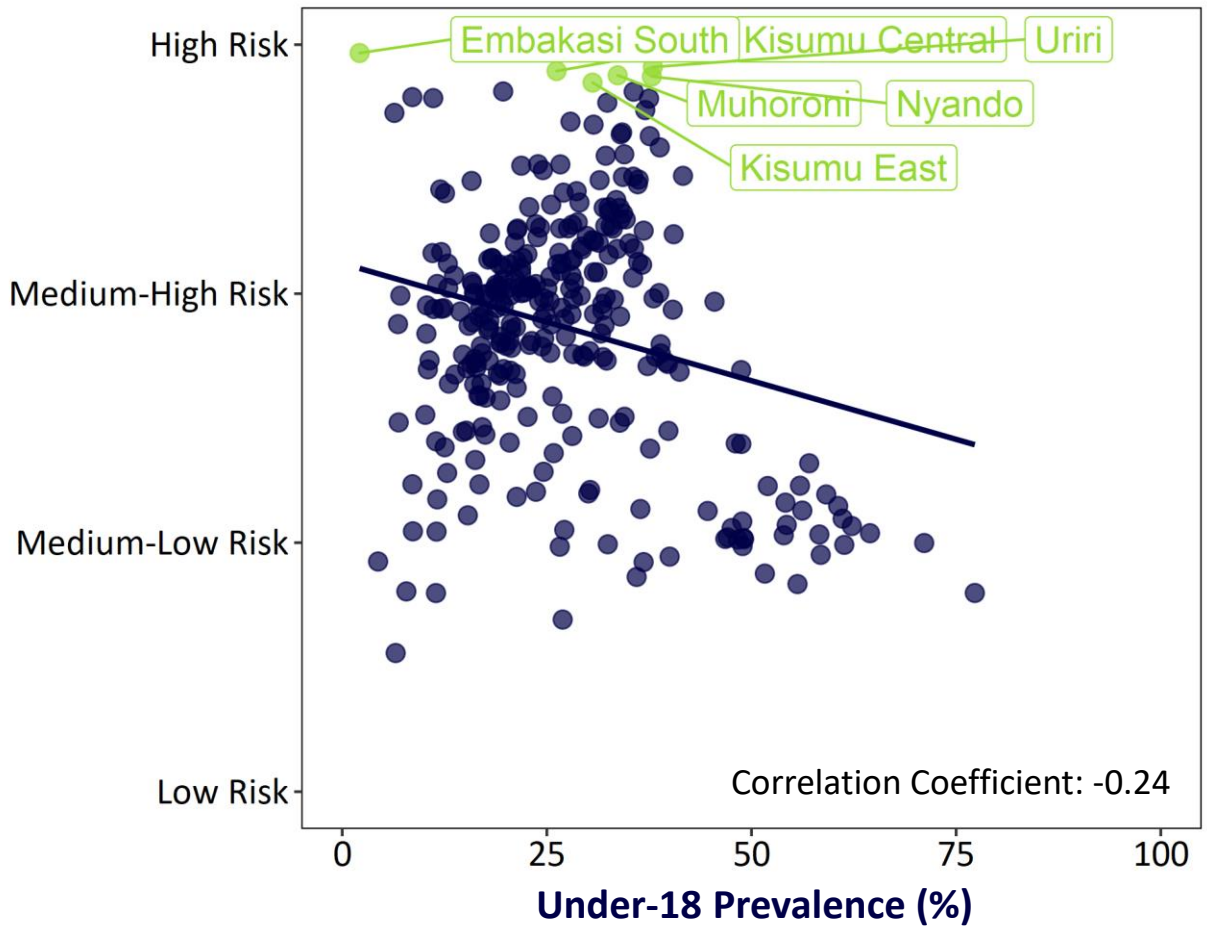
Source: Fraym, Kenya DHS 2014

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

At the sub-county level, there is no clear relationship between child marriage prevalence and pregnancy outside of marriage. Sub-counties with the highest risk have lower child marriage prevalence rates, such as Embakasi South.

Average Pregnancy Outside of Marriage Risk Category and Child Marriage Prevalence

Each dot represents a sub-county.



Source: Fraym

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

Literature suggests a strong relationship between poverty and child marriage. Based on expert consultation, Fraym measured poverty through education, employment, and overall wealth.[1]

1 **Education:** 40 percent of household heads with a daughter in the household have primary schooling or less.

2 **Employment:** Most household heads with a daughter in the household are employed, and roughly half of those employed work in unskilled manual labor or are self-employed in agriculture.[2] Among young women aged 15-24, only a third are employed, and of those employed, 43 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	40%
Employment	
Household heads with daughters, and who are employed	91%
Employed household heads with daughters, and who are working in unskilled manual labor or self-employed in agriculture	53%
Women (aged 15-24) who are employed	33%
Employed women (aged 15-24) working in unskilled manual labor or self-employed in agriculture	43%

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 unskilled manual labor or self-employment in agriculture as low opportunity jobs, or jobs that are likely to have low pay and/or poor working conditions.
Source: Fraym, Kenya DHS 2014

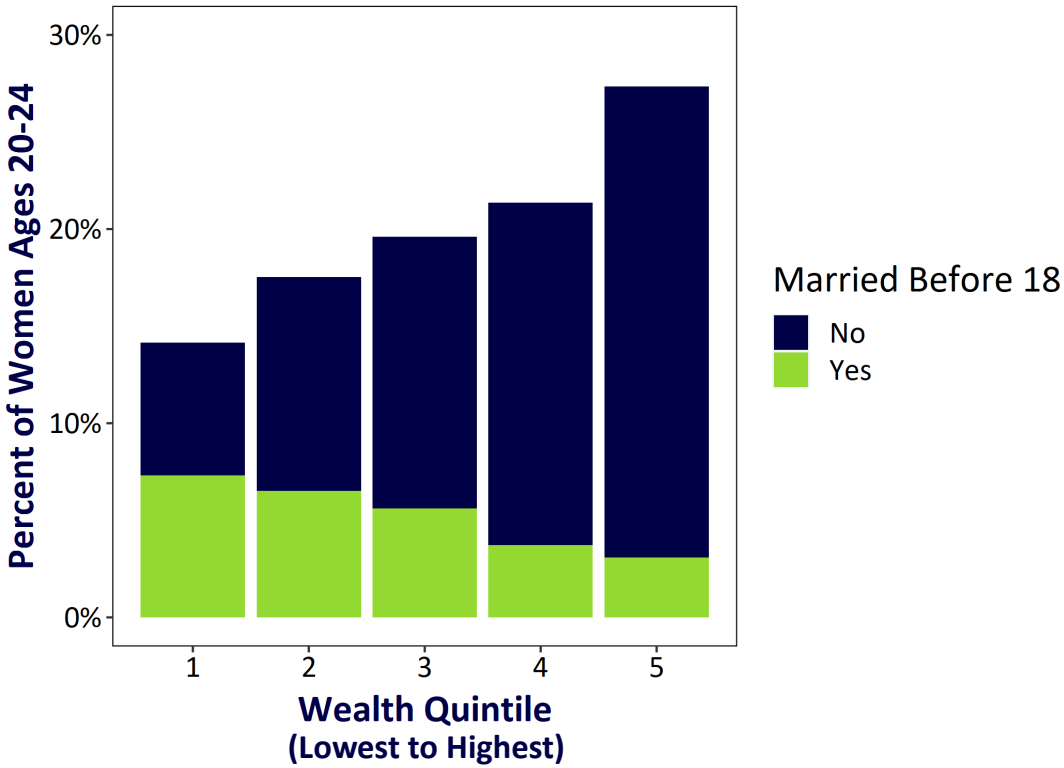
AT-RISK POPULATION || POVERTY & CHILD MARRIAGE (NATIONAL CONTEXT)

In Kenya, women aged 20-24 in the lowest quintile of the wealth index are four times more likely to have married before age 18 than women in the highest wealth quintile. Additionally, women married before age 18 are more likely to work in unskilled manual labor or self-employed in agriculture.

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	50%	54%
Employed women working in unskilled manual labor or self-employed in agriculture[2]	41%	50%

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



Note 1: The wealth index is a standard Demographic and Health Survey (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 unskilled manual labor or self-employment in agriculture as low opportunity jobs, or jobs that are likely to have low pay and/or poor working conditions.

Source: Fraym, Kenya DHS 2014

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 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 index scores at the community level (1 km^2).

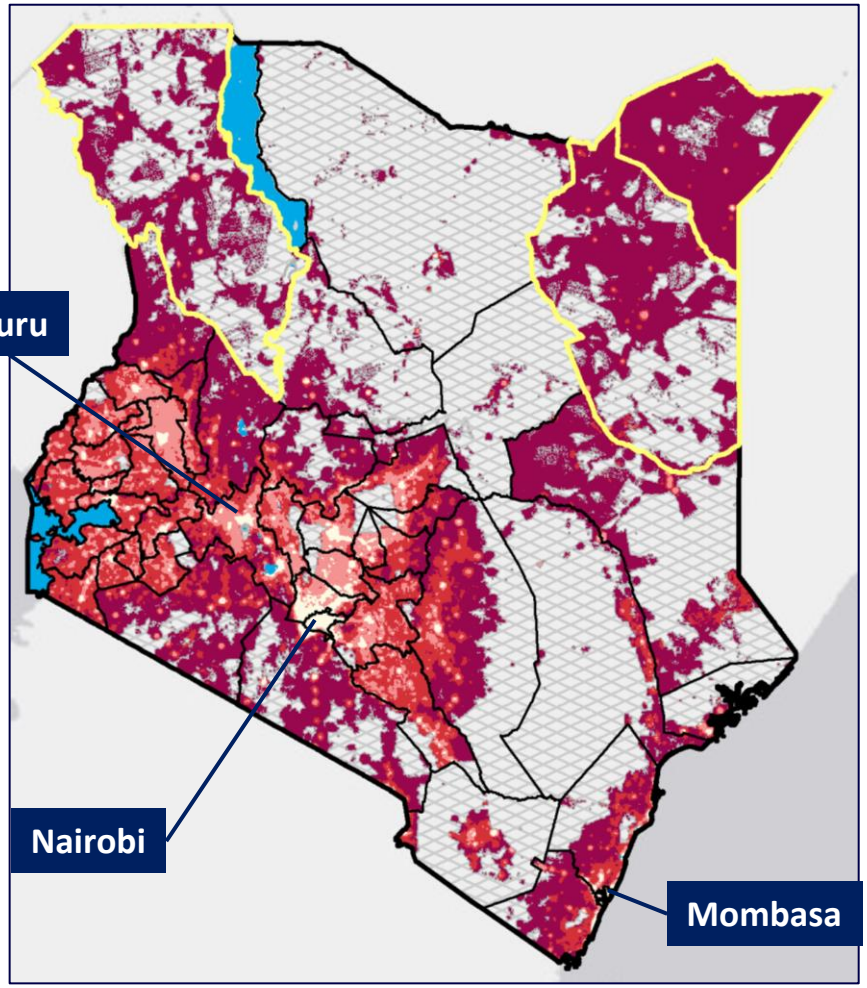
3. Fraym then **classified communities into quartiles with risk categories ranging from 1 to 4.** Communities with higher index values, or more impoverished as defined by the index, are categorized as a 4 ("high risk").

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).

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

There are an estimated 754,000 girls aged 10 to 14 who live in communities where poverty represent a high-risk factor 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
- Water bodies
- City — Large cities

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

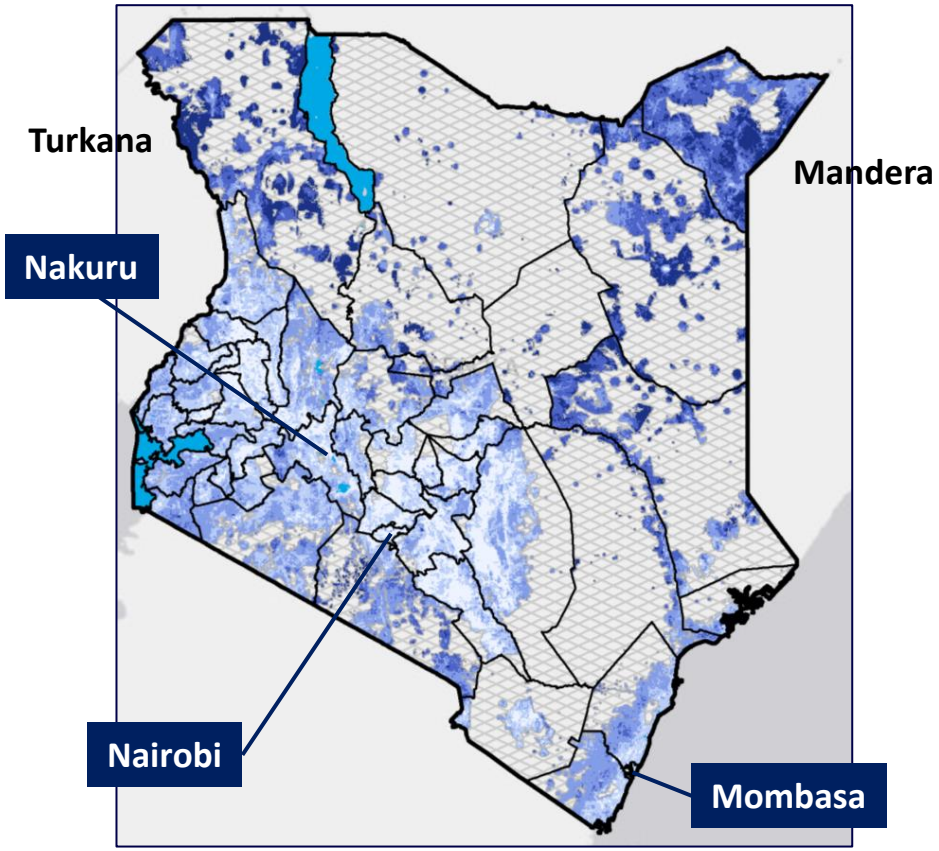
County	Population of at-risk girls (aged 10-14)
Mandera	178,500
Wajir	114,600
Turkana	78,800

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 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 a poverty index risk category equal to 4 (highest risk).
Source: Fraym, Kenya DHS 2014, Worldpop 2020

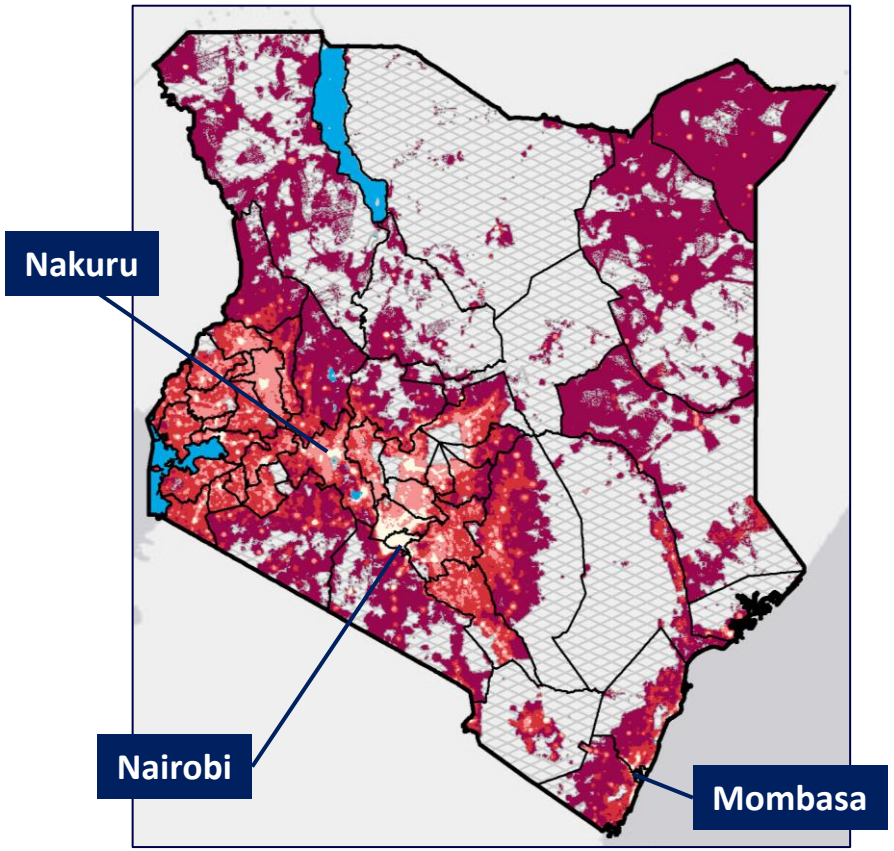
AT-RISK POPULATION || POVERTY & CHILD MARRIAGE (RISK PROFILE MAPPING)

High prevalence communities, such as Turkana and Mandera, are also markedly poor.

Child Marriage Prevalence



Poverty Index Risk Category[1]



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

0% 60%+

Areas with total population less than 10 people per sq km

City Large cities

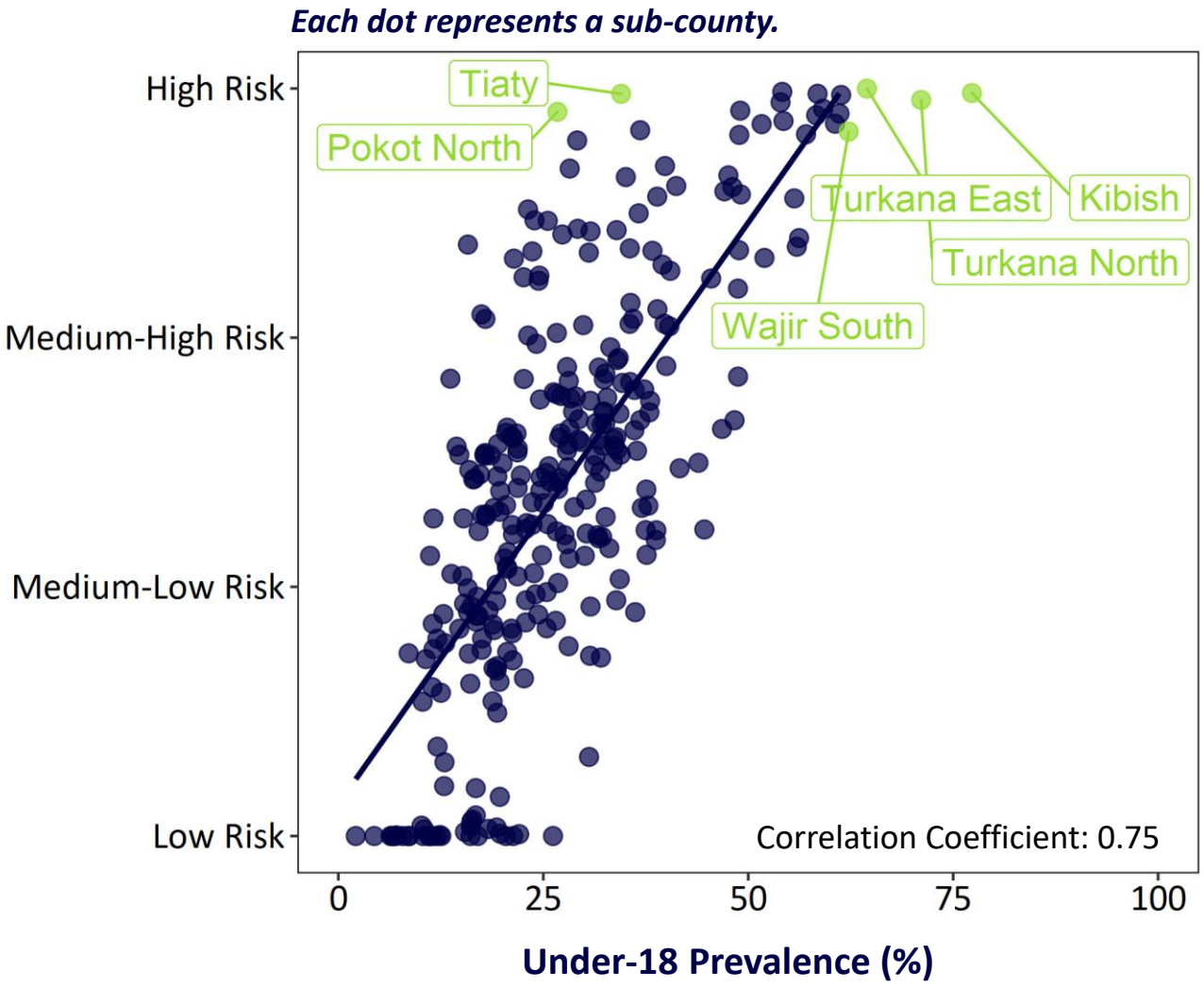
Low Risk
Medium-Low Risk
Medium-High Risk
High Risk

Note 1: The map shows the classification of 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 48 or the appendix for more details.

Source: Fraym, Kenya DHS 2014, Worldpop 2020

Sub-counties with high child marriage prevalence tend to show poverty as a high-risk factor for child marriage, as evidenced by the correlation coefficient.

Average Poverty Index Risk Category and Child Marriage Prevalence



Source: Fraym

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. In Kenya, 38 percent of men and 46 percent of women (aged 15-49) agree with at least one reason that justifies wife beating.

3. Women's greater participation in decision making may imply empowerment, and thus may be related to lower rates of child marriage. In Kenya, a majority of currently married women (aged 15-49) participate in household decisions.

Attitudes and behaviors, by sex		
	Women	**Men**
Domestic Violence		
Believe that there is at least one reason that justifies wife beating	46%	38%
Women's Participation in Decision Making[1]		
Respondent's healthcare	77%	-
Large household purchases	71%	-
Visits to family	73%	-
What food should be cooked each day	93%	-
Husband's earnings	57%	-

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, Kenya DHS 2014

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

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 estimated 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).

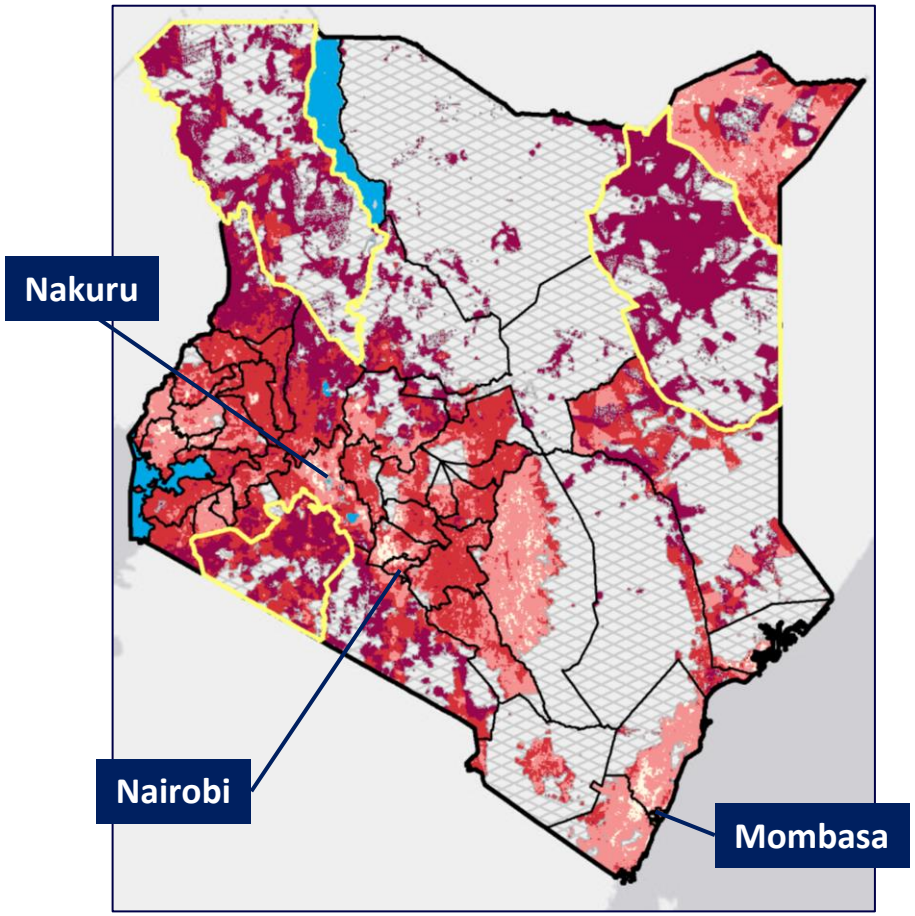
Indicator	Description	Correlation Coefficient with under-18 child marriage prevalence[1]	
		Women	Men
Domestic Violence			
Believe that there is at least one reason that justifies wife beating[2]	Proportion of women/men (aged 15-49) who agree with at least one reason that a husband is justified in hitting or beating his wife	0.28	0.19

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, Kenya DHS 2014

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

There are an estimated 475,000 girls aged 10 to 14 who live in communities where gender inequitable attitudes represents a high risk for child marriage.

Attitudes towards Wife Beating Risk Category[1]



Low Risk

Medium-Low Risk

Medium-High Risk

High Risk

Areas with total population less than 10 people per sq km

Water bodies

City Large cities

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

County	Population of at-risk girls (aged 10-14)
Wajir	141,500
Turkana	70,500
Narok	39,000

Note 1: The map shows the classification of attitudes towards wife beating for each 1km^2 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 53 or the appendix for more details.

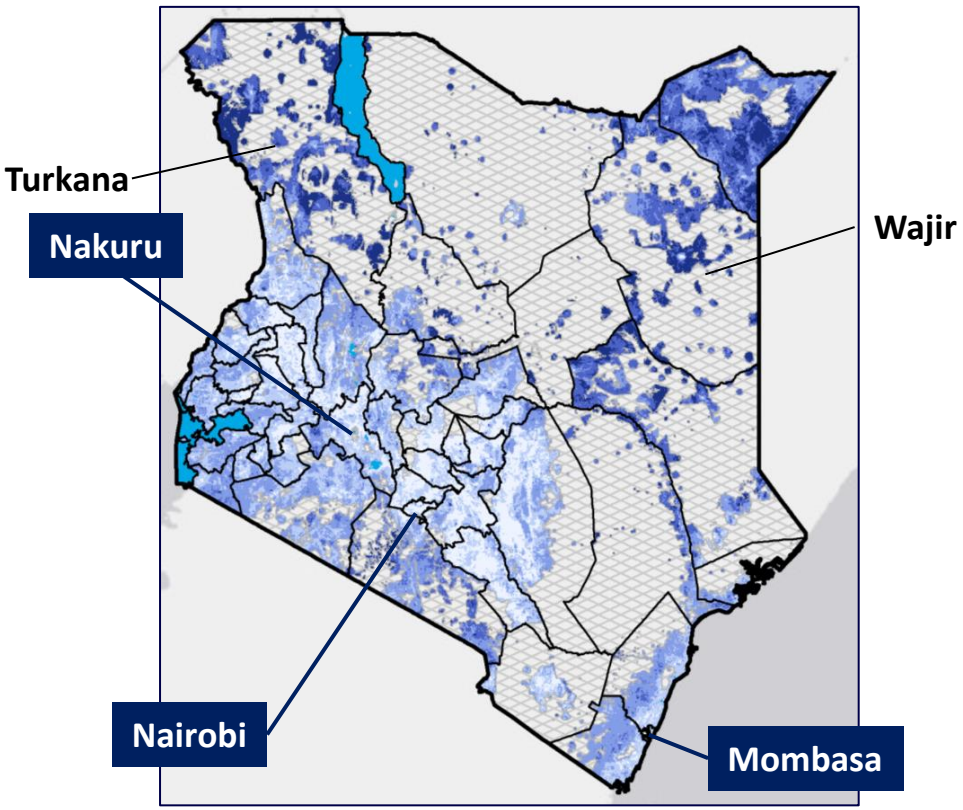
Note 2: At-risk girls are defined as girls at risk for child marriage, that is girls aged 10-14 who live in communities with an attitudes towards wife beating risk category equal to 4 (highest risk).

Source: Fraym, Kenya DHS 2014, Worldpop 2020

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

Some communities with high prevalence of child marriage, like Turkana and Wajir counties, also have high concentrations of gender inequitable attitudes.

Child Marriage Prevalence



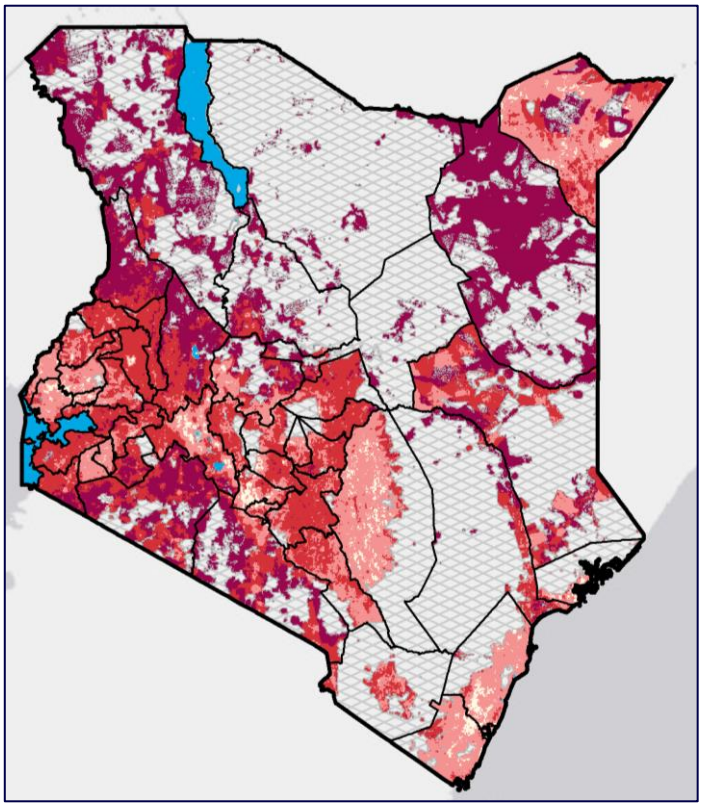
Percent of women (aged 20-24) who were married before 18

0% 60%+

Areas with total population less than 10 people per sq km

City Large cities

Attitudes towards Wife Beating Risk Category[1]



Low Risk
Medium-Low Risk
Medium-High Risk
High Risk

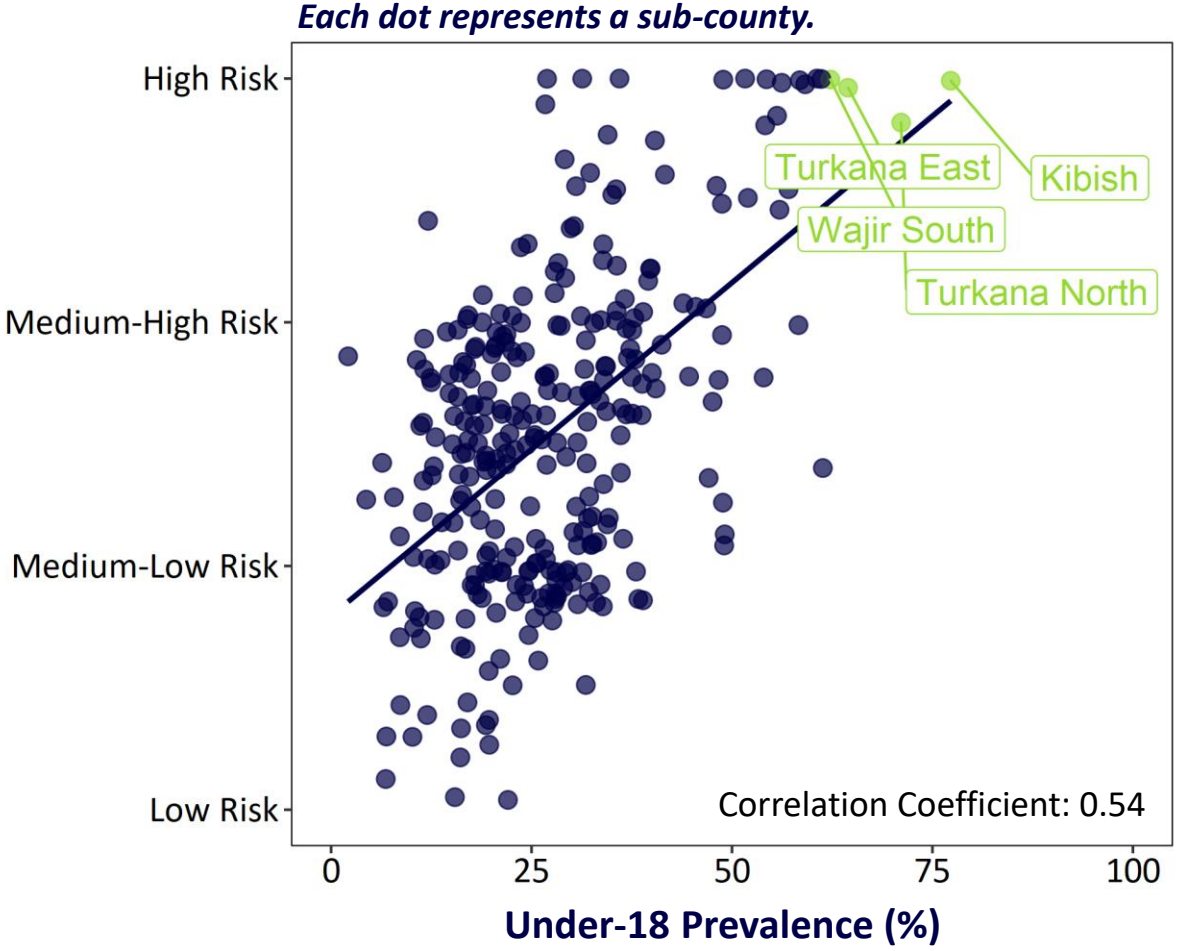
Note 1: The map shows the classification of attitudes towards wife beating for each 1km^2 cell into quartiles. The attitudes towards wife beating risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Attitudes towards wife beating is defined as belief that there is at least one reason that justifies wife beating. Please see slide 53 or the appendix for more details.

Source: Fraym, Kenya DHS 2014, Worldpop 2020

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

Sub-counties with high child marriage prevalence rates tend to be classified as higher risk on gender inequitable attitudes.

Average Attitudes towards wife beating Risk Category and Child Marriage Prevalence



Source: Fraym

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

Communities where women are more likely to report participating 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 the woman's healthcare is strongest.

Indicator	Description	Correlation Coefficient with under-18 child marriage prevalence
Women's Participation in Decision Making[1]		
Woman's healthcare	Proportion of currently married women (aged 15-49) who make the decision about their healthcare alone or jointly with partner	-0.17
Large household purchases	Proportion of currently married women (aged 15-49) who make the decision about large household purchases alone or jointly with partner	-0.10
Visits to family	Proportion of currently married women (aged 15-49) who make the decision about visits to family alone or jointly with partner	-0.15
What food should be cooked each day	Proportion of currently married women (aged 15-49) who make the decision about food cooked each day alone or jointly with partner	-0.09
Husband's earnings	Proportion of currently married women (aged 15-49) who make the decision husband's earnings alone or jointly with partner	-0.09

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.
Source: Fraym, Kenya DHS 2014

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

The decision-making risk profile reflects women's participation in several household decisions.

1. Fraym used **five indicators to assess women's participation in decision making in the household**: (i) woman's health care; (ii) large household purchases; (iii) visits to family; (iv) what food should be cooked each day; and (v) husband's earnings.

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

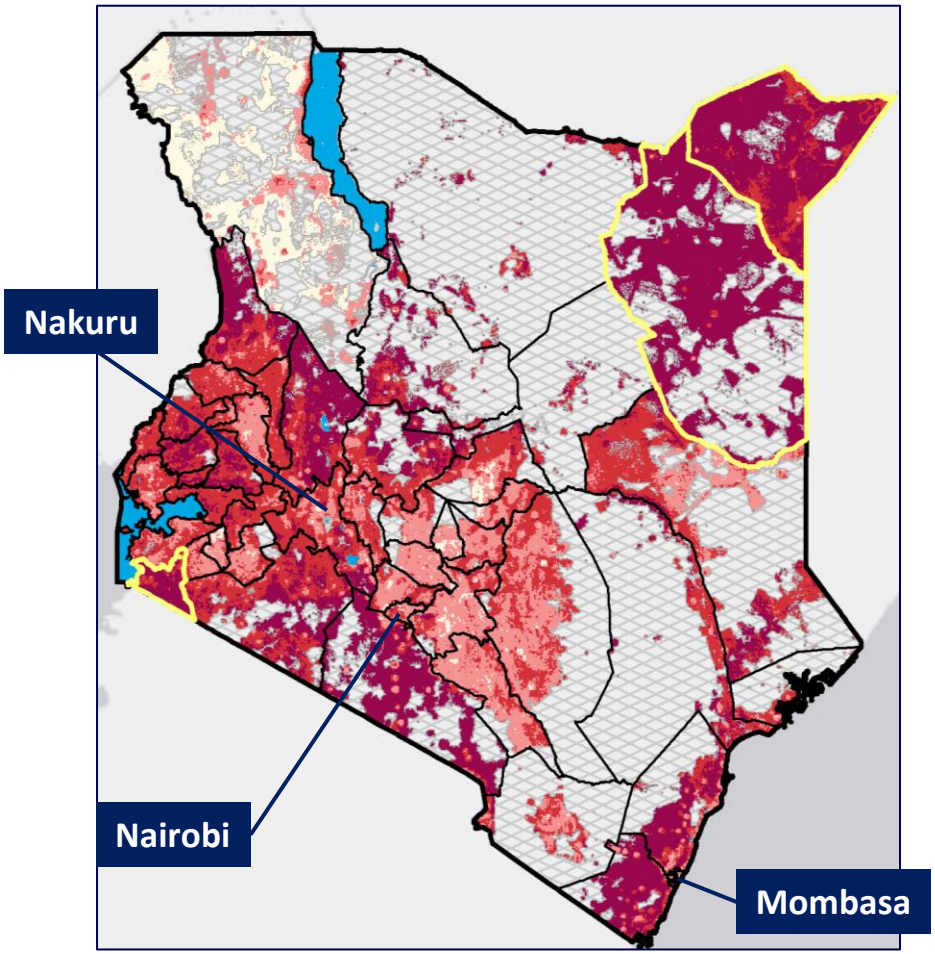
3. Fraym then **classified communities into quartiles with risk categories ranging from 1 to 4**. Communities with lower index values, or lower participation in decision-making, are categorized as a 4 ("high risk").

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 gender inequitable behavior, as measured by women's participation in decision-making, represents the highest risk for child marriage.

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

There are an estimated 750,000 girls aged 10 to 14 who live in communities where women's participation in decision-making represents a high risk factor for child marriage.

Women's Participation in Decision-Making 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

Water bodies

City Large cities

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

County	Population of at-risk girls (aged 10-14)
Mandera	163,100
Wajir	119,200
Migori	57,300

Note 1: The map shows the classification of women's participation in decision-making index for each 1km^2 cell into quartiles. The risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Please see slides 57-58 or the appendix for more details.

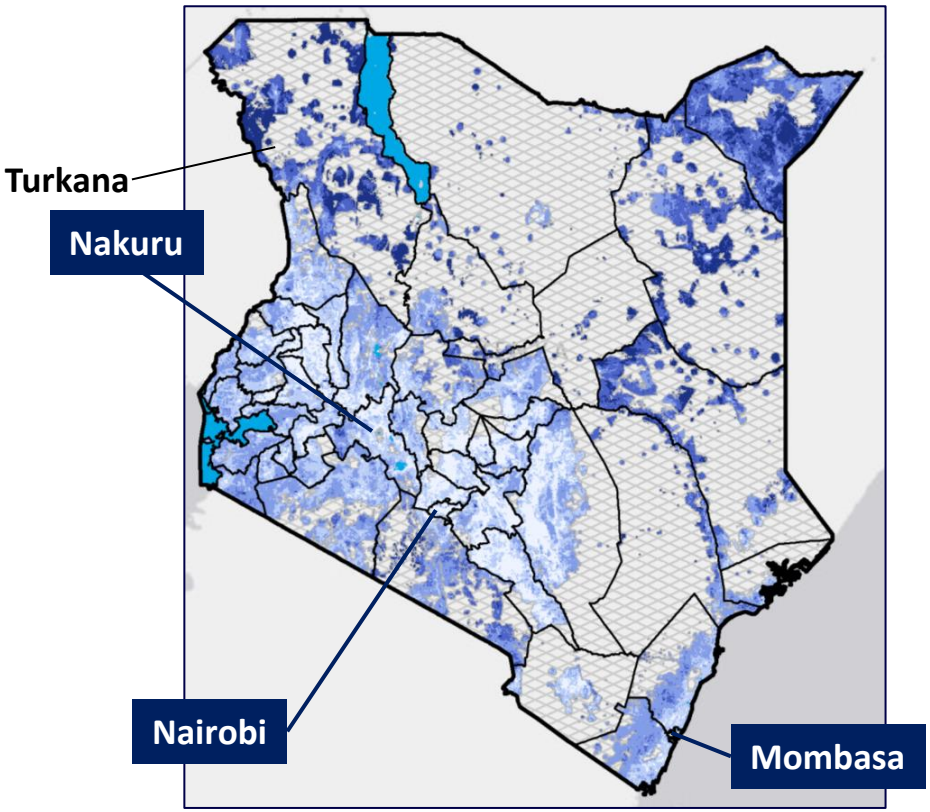
Note 2: At-risk girls are defined as girls at risk for child marriage, that is girls aged 10-14 who live in communities with a women's participation in decision-making index risk category equal to 4 (highest risk).

Source: Fraym, Kenya DHS 2014, Worldpop 2020

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

Turkana communities are low risk on the women's participation in decision-making index, despite having a high under-18 prevalence rate.

Child Marriage Prevalence



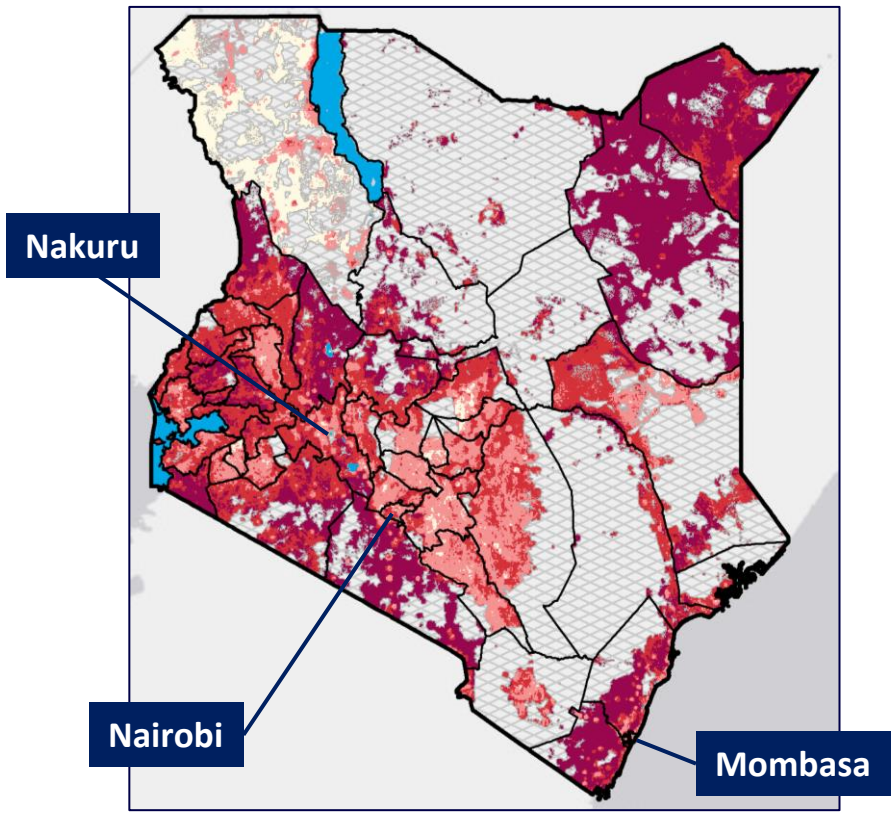
Percent of women (aged 20-24) who were married before 18

0% 60%+

Areas with total population less than 10 people per sq km

City Large cities

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



Low Risk
Medium-Low Risk
Medium-High Risk
High Risk

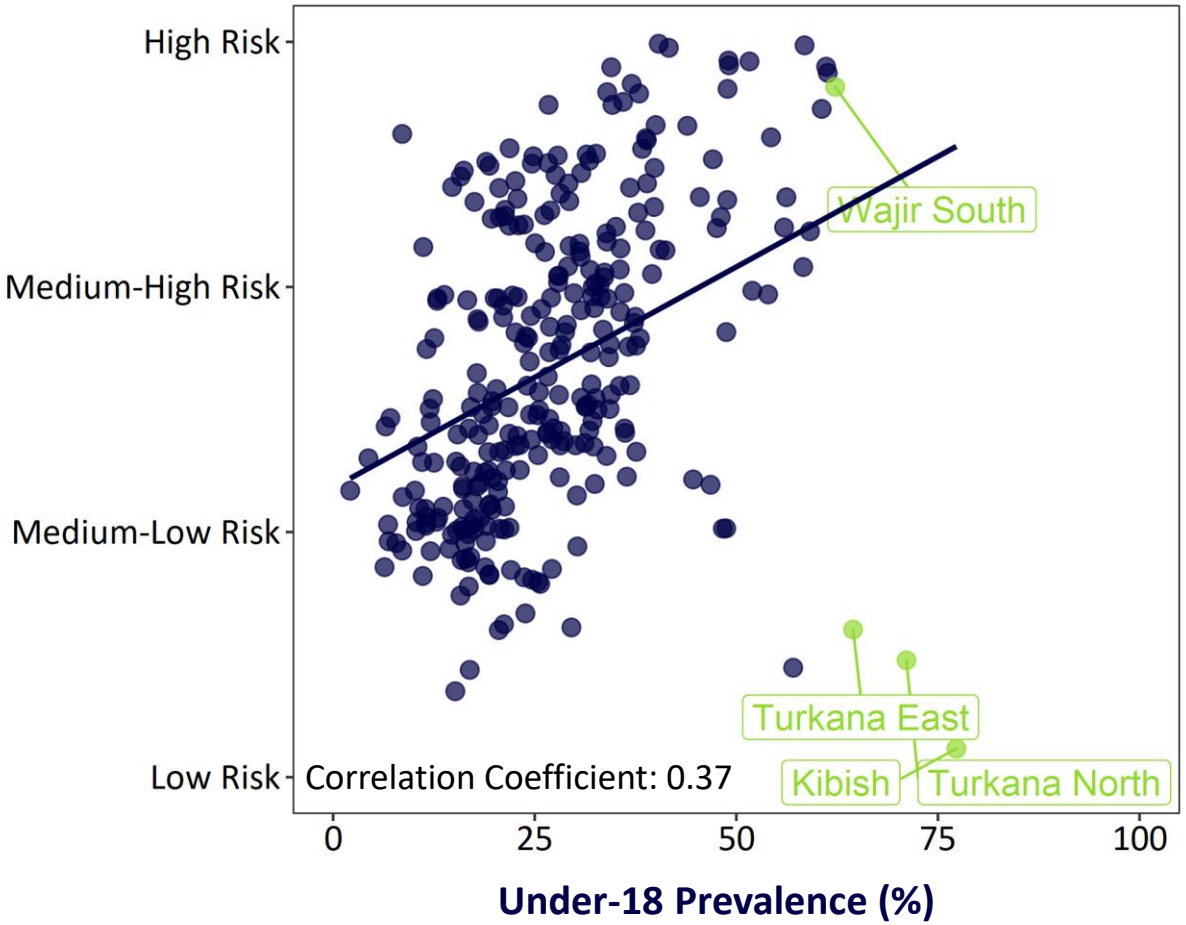
Note 1: The map shows the classification of women's participation in decision-making index for each 1km^2 cell into quartiles. The risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Please see slides 57-58 or the appendix for more details.

Source: Fraym, Kenya DHS 2014, Worldpop 2020

The relationship between women's participation in decision-making and under-18 prevalence is generally weak, with several high prevalence sub-counties being low risk.

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

Each dot represents a sub-county.



Source: Fraym

AT-RISK POPULATION || TOTAL RISK ACROSS ALL PROFILES

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: pregnancy outside of marriage, poverty, and gender equitable attitudes and behaviors. Each profile is equally weighted.

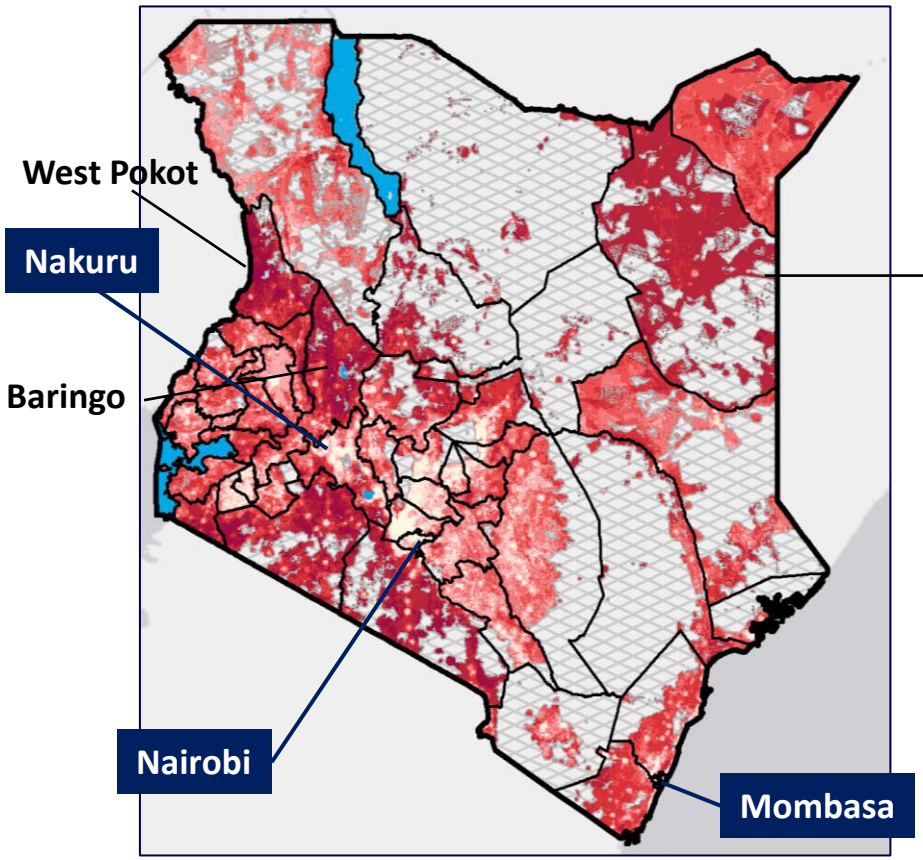
2. The total risk categories range on a 4 to 16 scale, with 16 indicating the highest level of risk. Communities with a score of 16 are classified as high risk on all profiles.

3. There are about 12,000 girls aged 10 to 14 who live in communities classified as high risk on all profiles.

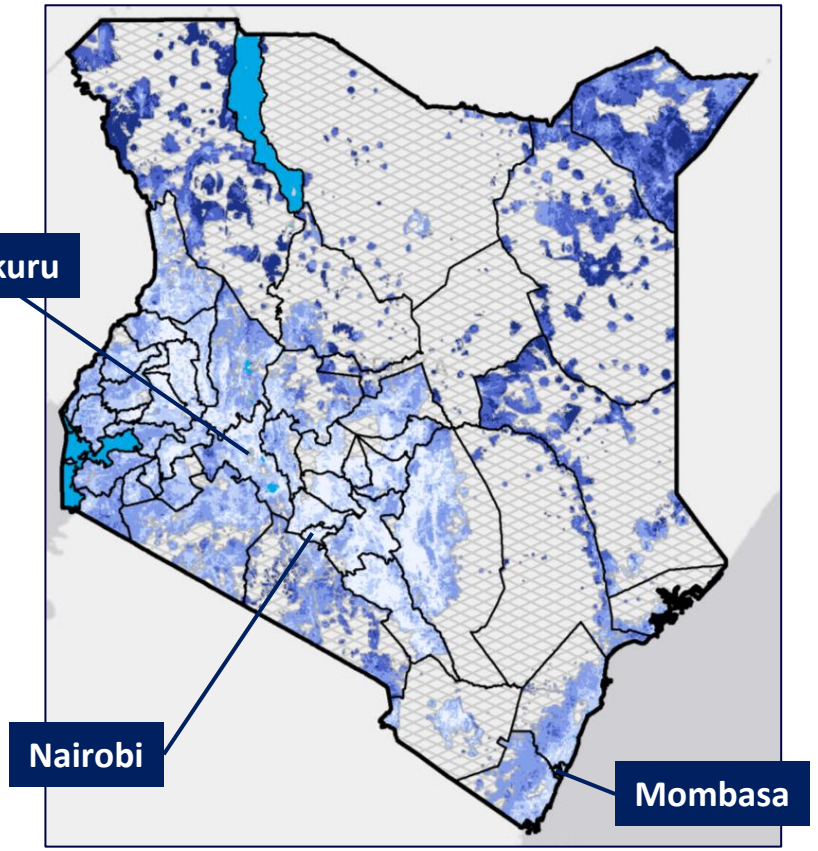
AT-RISK POPULATION || TOTAL RISK ACROSS ALL PROFILES

Much of Wajir county is higher risk across all profiles and has high under-18 prevalence, whereas West Pokot and Baringo have high total risk, but low under-18 prevalence.

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% — 60%+

Note 1: The total risk categories range on a 4 to 16 scale, with 16 indicating the highest level of risk. The index is the sum of pregnancy outside of marriage, poverty, and gender equitable attitudes and decision-making, and equally weights each component.

Source: Fraym, Kenya DHS 2014, Worldpop 2020

AT-RISK POPULATION || KEY TAKEAWAYS

Poverty as a risk factor is most strongly associated with child marriage. This risk factor has the highest number of at-risk girls.

1. **Pregnancy outside of marriage is largely concentrated around Lake Victoria**. In communities classified as high risk, there are an estimated 554,000 at-risk girls aged 10-14. However, not all high-risk communities have a high prevalence rate.

2. **Northern Kenya has higher concentrations of poverty** as defined by the index. There are an estimated 754,000 girls aged 10 to 14 who live in these high-risk communities. At 43%, the under-18 prevalence rate in high risk communities is notably higher than in lower risk communities.

3. **Communities where women participate the least in household decision-making are concentrated in the northeast, whereas most communities in northern Kenya hold negative attitudes towards wife beating**. There are an estimated 475,000 girls aged 10 to 14 in communities where attitudes represent a high risk and 750,000 girls aged 10 to 14 in communities where decision-making represents a high risk.

4. **In Wajir county, most communities have higher total risk and have a high under-18 prevalence rate**. However, other communities with higher risk, like West Pokot and Baringo, have lower under-18 prevalence rates.

Hotspot Analysis

Bringing together the previous sections, Fraym identified three hotspots for child marriage: Turkana, Mandera, and Samburu counties.

1. Fraym defined hotspots as **counties 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 county 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. **Turkana county has the highest under-18 and under-15 prevalence rates**. In many Turkana communities, poverty is an important risk factor for child marriage. However, pregnancy as a potential risk factor is less widespread and appears to be concentrated in a few geographic areas.

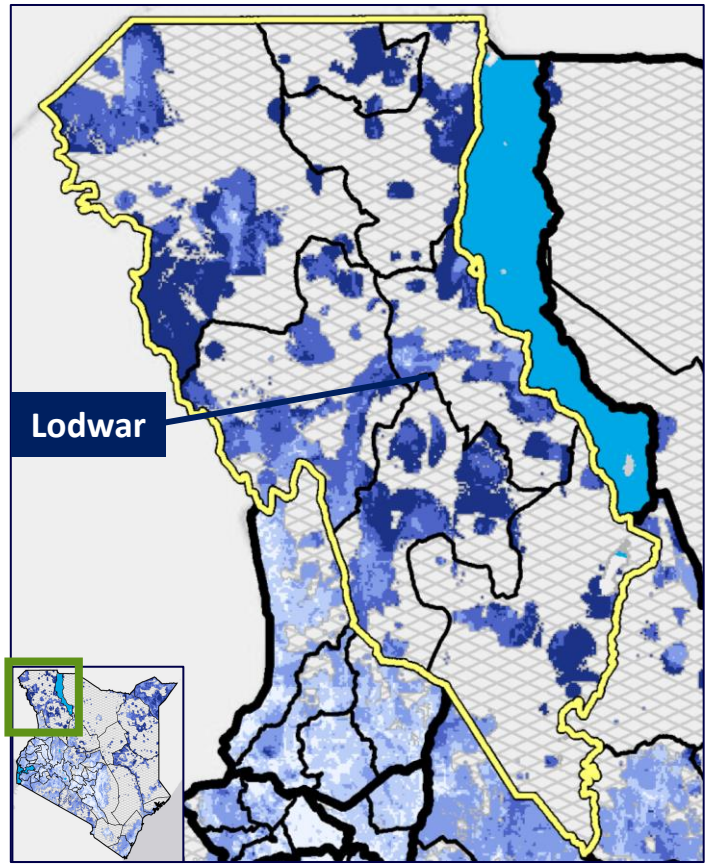
4. **Mandera county has the third highest under-18 prevalence rate, yet is significantly more populated than Wajir county (second highest).** Poverty as a potential risk factor for child marriage is widespread while pregnancy outside of marriage as a risk factor is much lower across the county.

5. **Samburu county has the second highest under-15 prevalence rate** and the eighth highest under-18 prevalence rate. In most communities, poverty is an important risk factor for child marriage. There are only a few communities where pregnancy outside of marriage represents a likely risk factor.

HOTSPOT ANALYSIS || TURKANA COUNTY (OVERVIEW)

Much of Turkana county's populated areas have a high prevalence rate, although there are small pockets with lower rates.

Turkana county has the highest under-18 prevalence rate – 57%



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

0% **60%+**

Areas with total population less than 10 people per sq km

City County capital

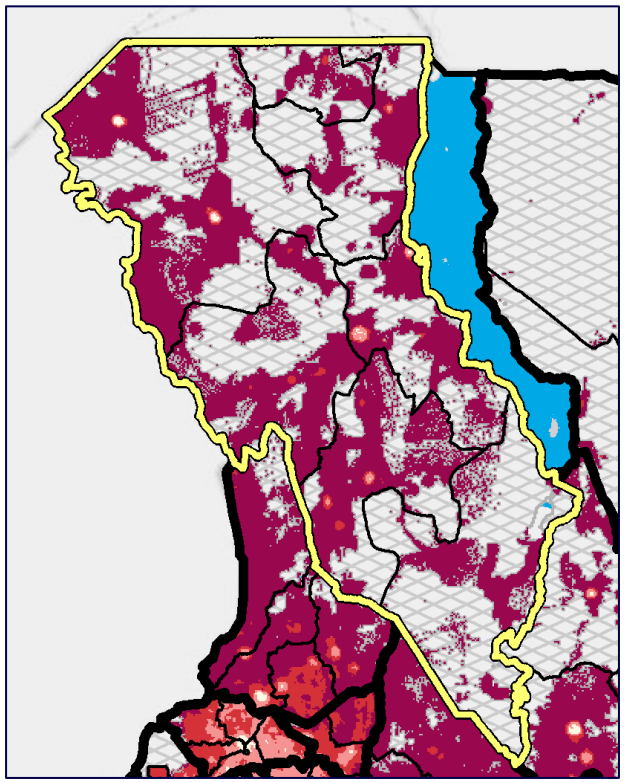
Key Indicators	
Under-18 Prevalence	57%
Under-18 Burden	19,400
Percent of adults (aged 15-49) who are employed	35%
Percent of women (aged 15-49) who are employed	26%
Percent of women (aged 18-49) who completed primary education or higher	10%
Percent of women (aged 15-24) who are sexually active and use a modern contraceptive method	3%
Percent of individuals in a household with access to electricity	7%
Percent of individuals in a household with a flush toilet	2%

Source: Fraym, Kenya DHS 2014

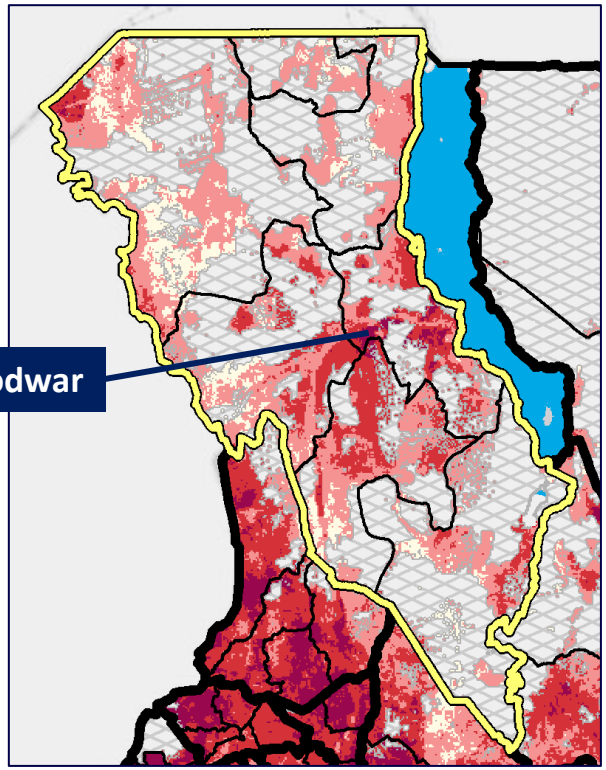
HOTSPOT ANALYSIS || TURKANA COUNTY (RISK PROFILE MAPPING)

Areas where poverty is a high-risk factor are widespread, whereas pregnancy as a risk factor for child marriage is concentrated in more populated areas like Lodwar.

Poverty Index Risk Category[1]



Pregnancy Outside of Marriage Risk Category[2]



- Low Risk
- Medium-Low Risk
- Medium-High Risk
- High Risk

City County capital

Areas with total population less than 10 people per sq km

Population of at-risk girls (aged 10-14) due to poverty as a factor[3]	78,750

Population of at-risk girls (aged 10-14) due to pregnancy as a factor[3]	1,300

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 48 or the appendix for more details.

Note 2: The map shows the classification of pregnancy outside of marriage for each 1km^2 cell into quartiles. The pregnancy outside of marriage risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. See slide 42 or the appendix for more details.

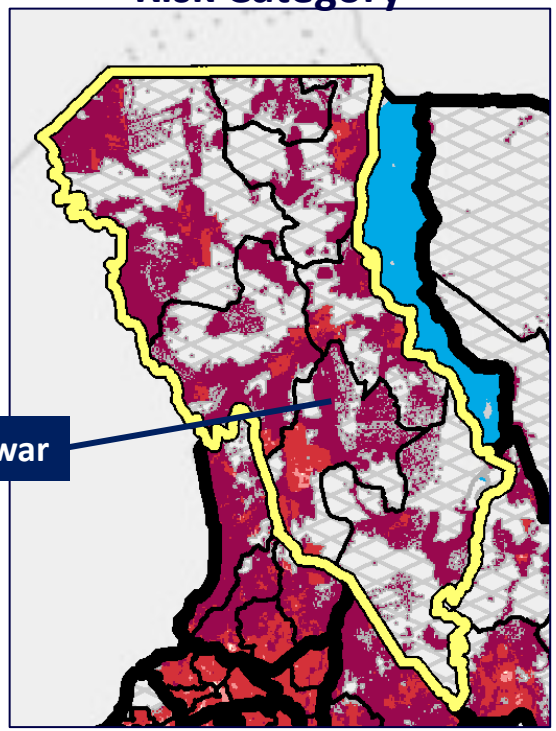
Note 3: At-risk girls are defined as girls at risk for child marriage, that is girls aged 10-14 who live in communities with a poverty index risk category or pregnancy outside of marriage risk category equal to 4 (highest risk).

Source: Fraym, Kenya DHS 2014, Worldpop 2020

HOTSPOT ANALYSIS || TURKANA COUNTY (RISK PROFILE MAPPING)

Gender inequitable attitudes represent a high-risk factor for child marriage in Turkana, yet women's participation in decision-making is less of a factor.

Attitudes Towards Wife Beating Risk Category[1]



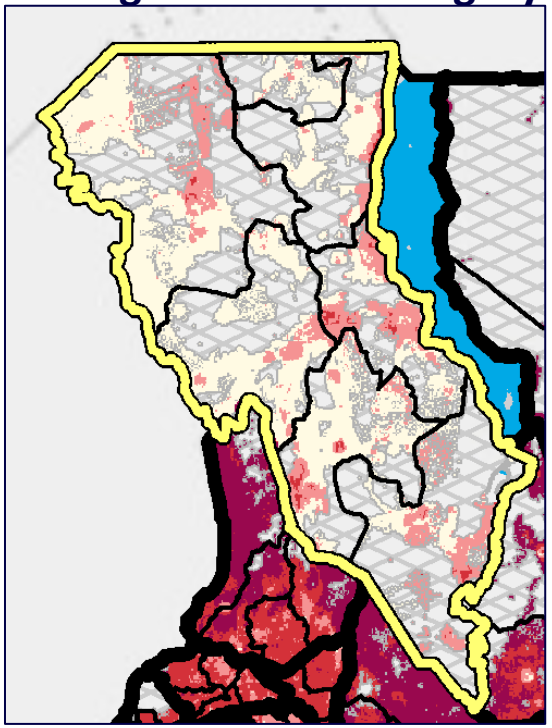
Population of at-risk girls (aged 10-14) due to attitudes as a factor[3]	70,500

Low Risk
Medium-Low Risk
Medium-High Risk
High Risk

City County capital

Areas with total population less than 10 people per sq km

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



Population of at-risk girls (aged 10-14) due to decision-making as a factor[3]	670

Note 1: The map shows the classification of attitudes towards wife beating for each 1km^2 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 53 or the appendix for more details.

Note 2: The map shows the classification of women's participation in decision-making index for each 1km^2 cell into quartiles. The risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Please see slides 57-58 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, Kenya DHS 2014, Worldpop 2020

HOTSPOT ANALYSIS || TURKANA COUNTY (INFRASTRUCTURE AND SERVICES)

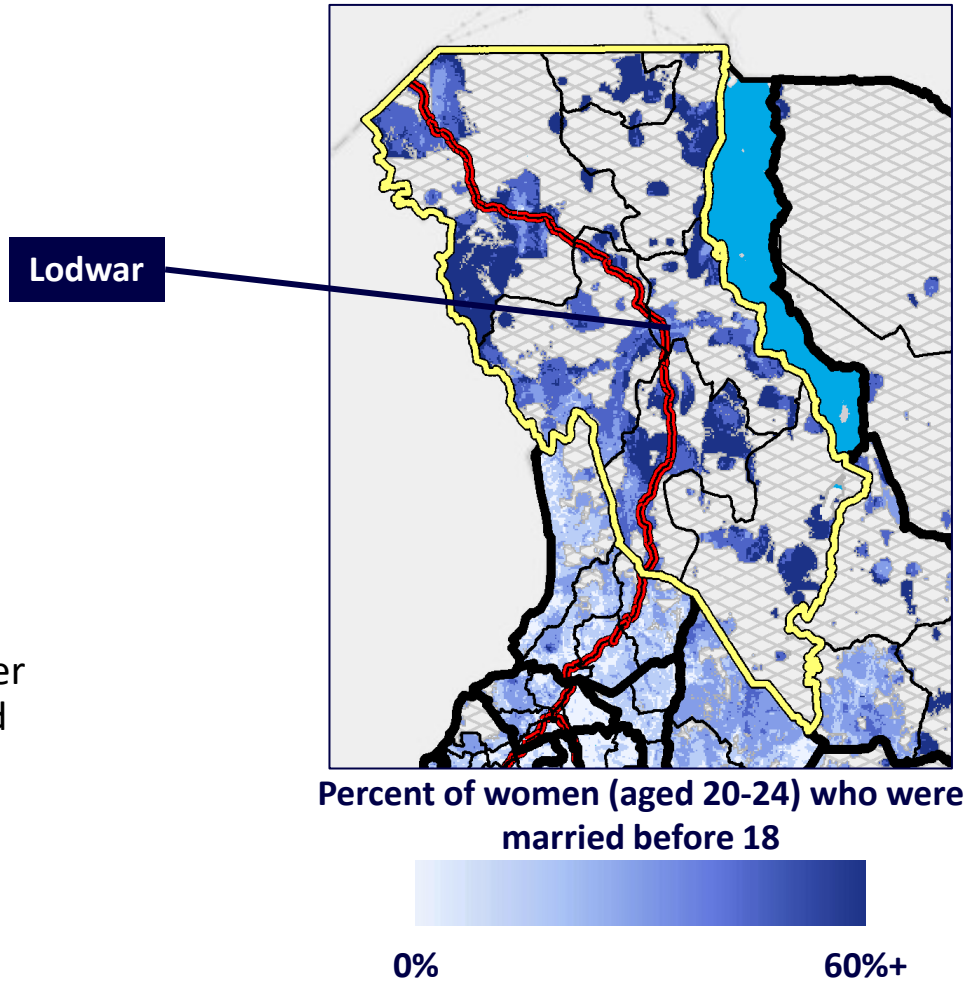
Infrastructure affects service delivery, which may have implications for child marriage. In Turkana, infrastructure access is limited, especially in high prevalence communities.

1. The road network is limited in sparsely-populated Turkana. The major highway in the county runs from the South Sudanese border to the south of the county.

2. There are roughly 14 public health centers per 100,000 people, which is slightly above the national rate (11 per 100,000 people).[2]

3. There are 25 schools per 100,000 people, which is well below the national rate (47 per 100,000 people). Limited school access and educational outcomes may be a factor in child marriage prevalence. [3]

Major Roads in Turkana County[1]

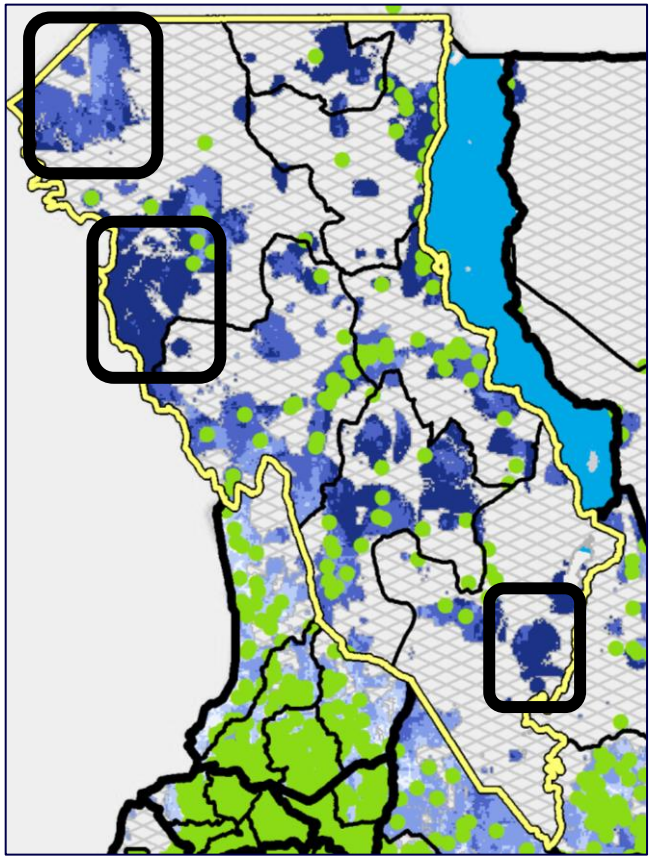


Note 1: Major roads include motorways, trunk roads, and primary roads, which are the most important roads in a country's road network.
Note 2: Public health centers come from the World Health Organization
Note 3: School data comes from the Kenya Open Data Portal. Schools include both public and private primary and secondary schools.
Source: Fraym, Kenya DHS 2014

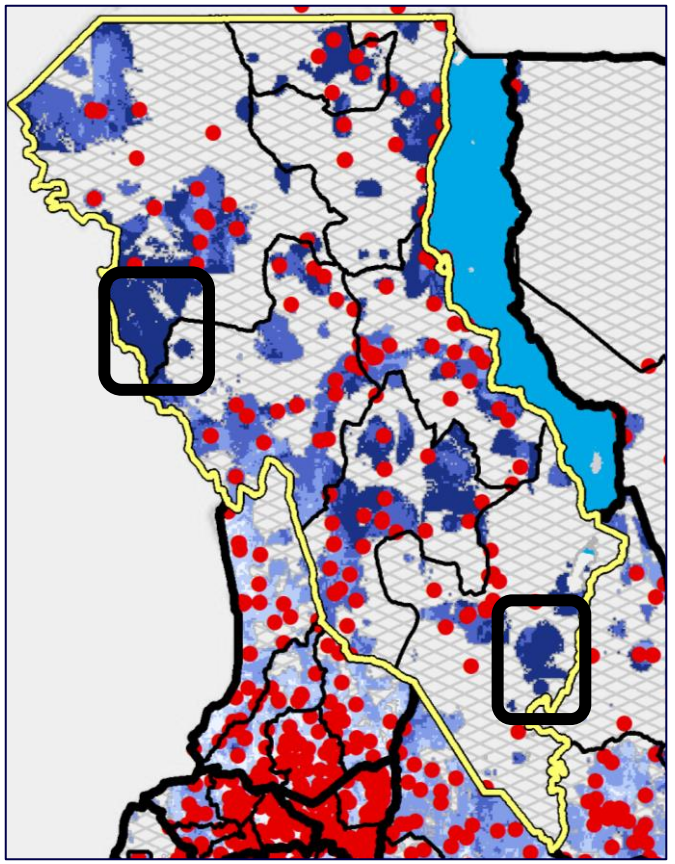
HOTSPOT ANALYSIS || TURKANA COUNTY (SCHOOLS AND CLINICS)

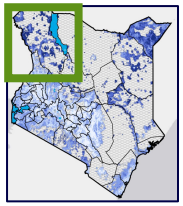
There are several high prevalence areas that appear to lack schools or health centers.

Public Primary and Secondary Schools



Public Health Centers





Under 18 Prevalence

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

0% **60%+**

Areas with total population less than 10 people per sq km

Source: Fraym, Kenya DHS 2014, Kenya Open Data Portal, WHO

HOTSPOT ANALYSIS || TURKANA COUNTY (SUB-COUNTY LEVEL DATA)

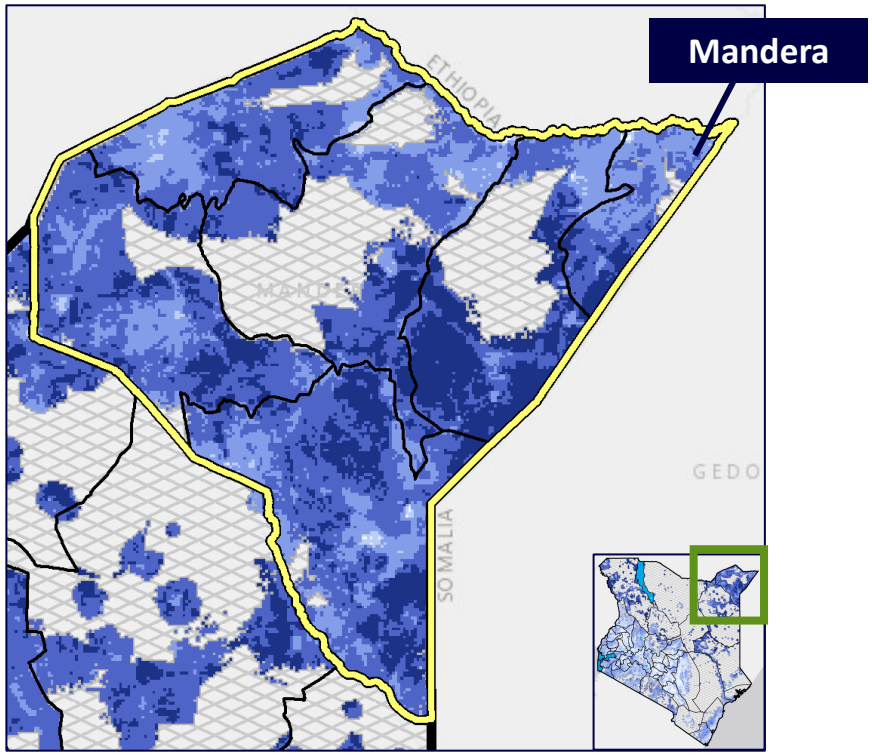
Kibish and Turkana North, the least populated sub-counties, have the highest under-18 prevalence rates.

Indicator	Turkana West	Kibish	Turkana North	Loima	Turkana Central	Turkana South	Turkana East
Child Marriage							
Under-18 Prevalence	56%	77%	71%	54%	49%	57%	64%
Population of At-Risk Girls (aged 10-14), by Profile							
Pregnancy	70	-	-	30	1,050	150	< 10
Poverty	21,400	2,400	6,900	13,500	9,400	14,450	10,700
Gender Inequitable Attitudes	22,500	2,400	6,000	11,300	8,200	9,700	10,400
Limited Decision-Making	-	-	-	400	<10	240	45
Community Characteristics							
Total Population	329,100	27,200	84,100	170,400	187,300	196,300	110,000
Number of Health Centers and Schools per 100,000 people	33	9	16	51	77	32	17
Percent of women (aged 15-49) who are employed	20%	23%	25%	28%	35%	29%	19%
Percent of women (aged 18-49) who completed primary education or higher	8%	6%	6%	5%	21%	9%	5%

HOTSPOT ANALYSIS || MANDERA COUNTY (OVERVIEW)

Mandera county has the third highest under-18 prevalence rate. The under-18 child marriage burden in Mandera is roughly 1.5 times larger than in Wajir, which has the second highest under-18 prevalence rate.

Mandera county has the third highest under-18 prevalence rate – 49%



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

0% — **60%+**

Areas with total population less than 10 people per sq km

City County capital

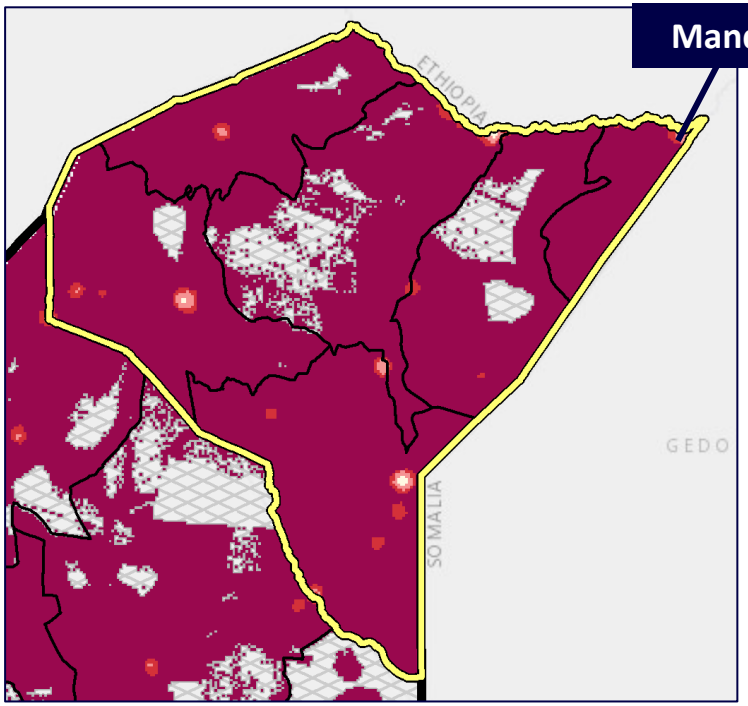
Key Indicators	
Under-18 Prevalence	49%
Under-18 Burden	20,000
Percent of adults (aged 15-49) who are employed	41%
Percent of women (aged 15-49) who are employed	8%
Percent of women (aged 18-49) who completed primary education or higher	9%
Percent of women (aged 15-24) who are sexually active and use a modern contraceptive method	1%
Percent of individuals in households with access to electricity	9%
Percent of individuals in households with a flush toilet	2%

Source: Fraym, Kenya DHS 2014

HOTSPOT ANALYSIS || MANDERA COUNTY (RISK PROFILE MAPPING)

Much of Mandera county is comprised of communities where poverty represents a risk factor for child marriage. Pregnancy as a risk factor is much lower.

Poverty Index Risk Category[1]



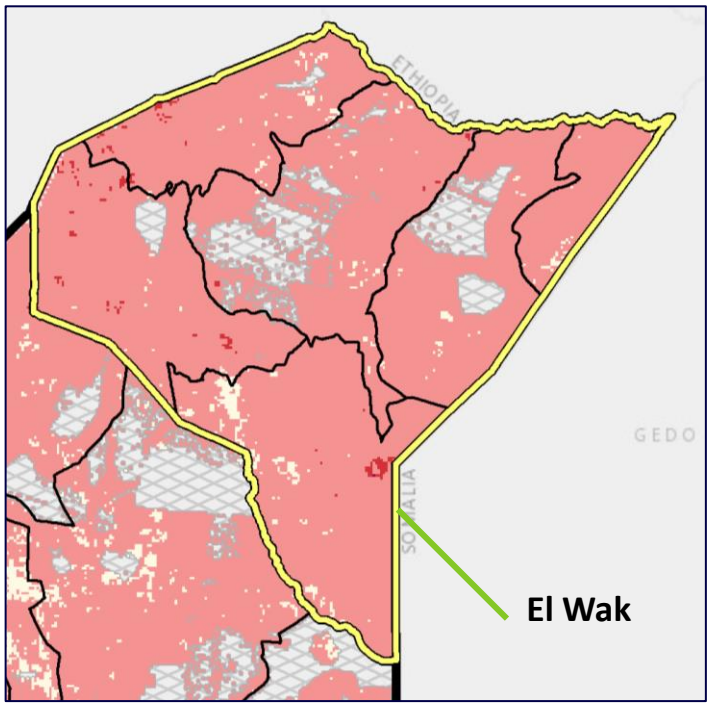
Population of at-risk girls (aged 10-14) due to poverty as a factor[3]	178,500

Low Risk
Medium-Low Risk
Medium-High Risk
High Risk

City County capital

Areas with total population less than 10 people per sq km

Pregnancy Outside of Marriage Risk Category



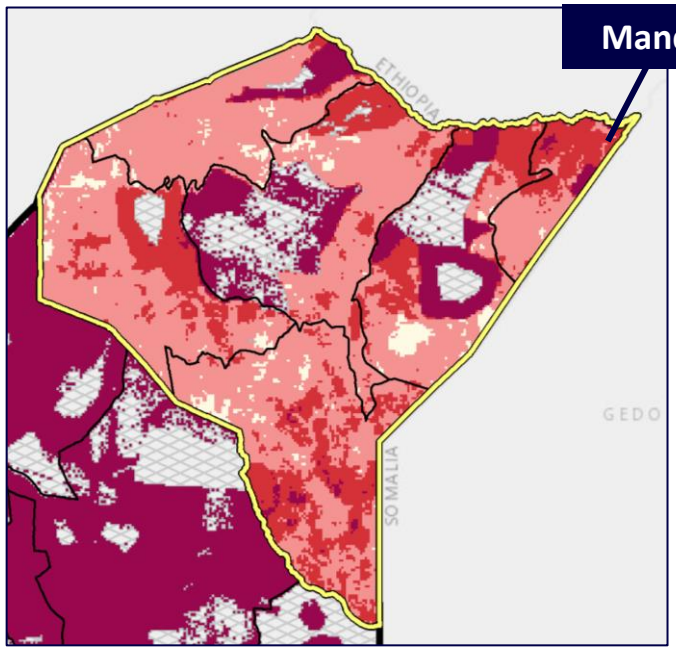
Population of at-risk girls (aged 10-14) due to pregnancy as a factor[3]	60

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 48 or the appendix for more details.
Note 2: The map shows the classification of pregnancy outside of marriage for each 1km^2 cell into quartiles. The pregnancy outside of marriage risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. See slide 42 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 a poverty index risk category or pregnancy outside of marriage risk category equal to 4 (highest risk).
Source: Fraym, Kenya DHS 2014, Worldpop 2020

HOTSPOT ANALYSIS || MANDERA COUNTY (RISK PROFILE MAPPING)

Some areas in Mandera county are at a higher risk of gender inequitable attitudes as a risk factor for child marriage, whereas women's participation in decision-making represents a high-risk factor throughout the county.

Attitudes Towards Wife Beating Risk Category[1]



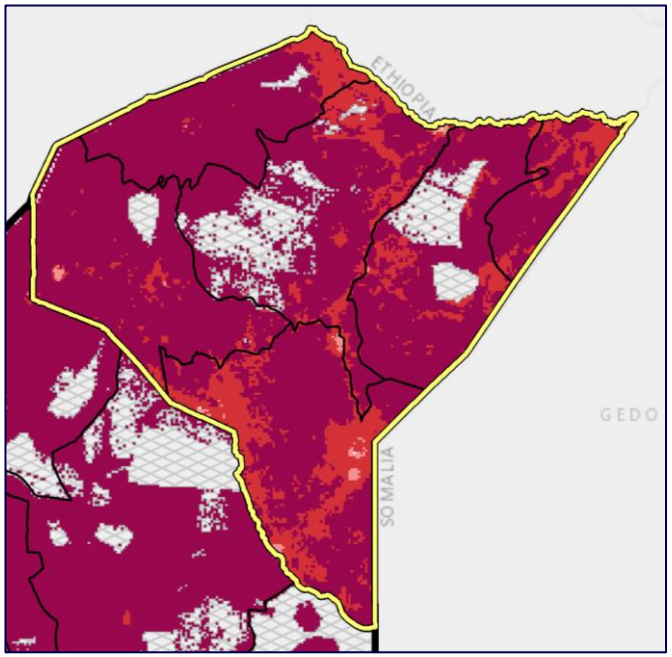
Population of at-risk girls (aged 10-14) due to attitudes as a factor[3]	12,100

Low Risk
Medium-Low Risk
Medium-High Risk
High Risk

City County capital

Areas with total population less than 10 people per sq km

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



Population of at-risk girls (aged 10-14) due to decision-making as a factor[3]	163,100

Note 1: The map shows the classification of attitudes towards wife beating for each 1km^2 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 53 or the appendix for more details.

Note 2: The map shows the classification of women's participation in decision-making index for each 1km^2 cell into quartiles. The risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Please see slides 57-58 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, Kenya DHS 2014, Worldpop 2020

HOTSPOT ANALYSIS || MANDERA COUNTY (INFRASTRUCTURE AND SERVICES)

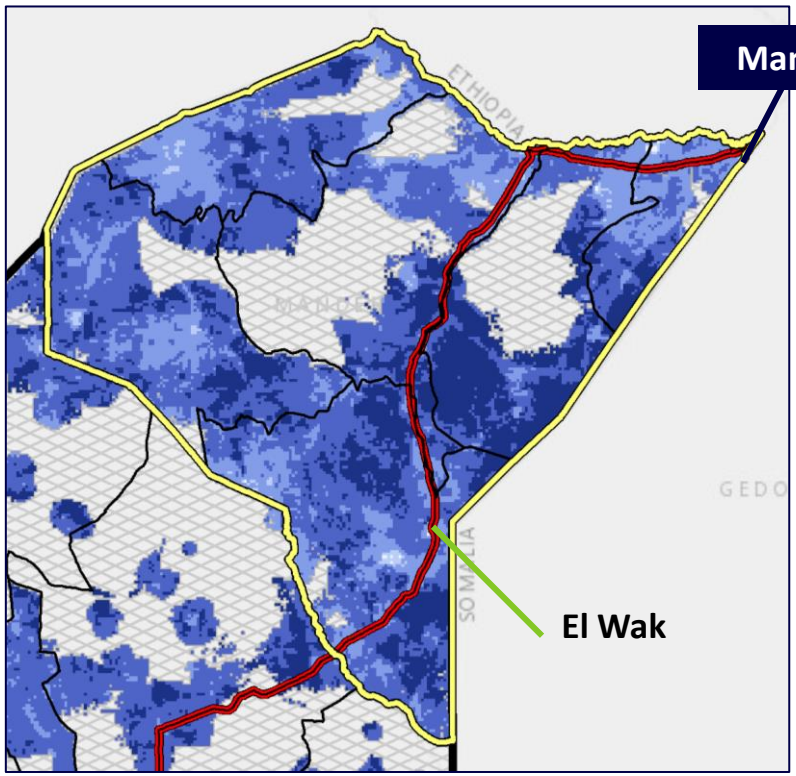
Despite its larger population, infrastructure remains relatively limited in Mandera county.

1. There is a single major road that runs through the larger towns in the eastern part of Mandera county. These are the same areas with higher child marriage prevalence.

2. There are roughly 2 public health centers per 100,000 people, which is well below the national rate (11 per 100,000 people).[2] Lack of access to health may be positively related to child marriage.

3. There are seven public schools per 100,000 people, which indicates a severe shortage of schools relative to the national rate.[3]

Major Roads in Mandera County[1]



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

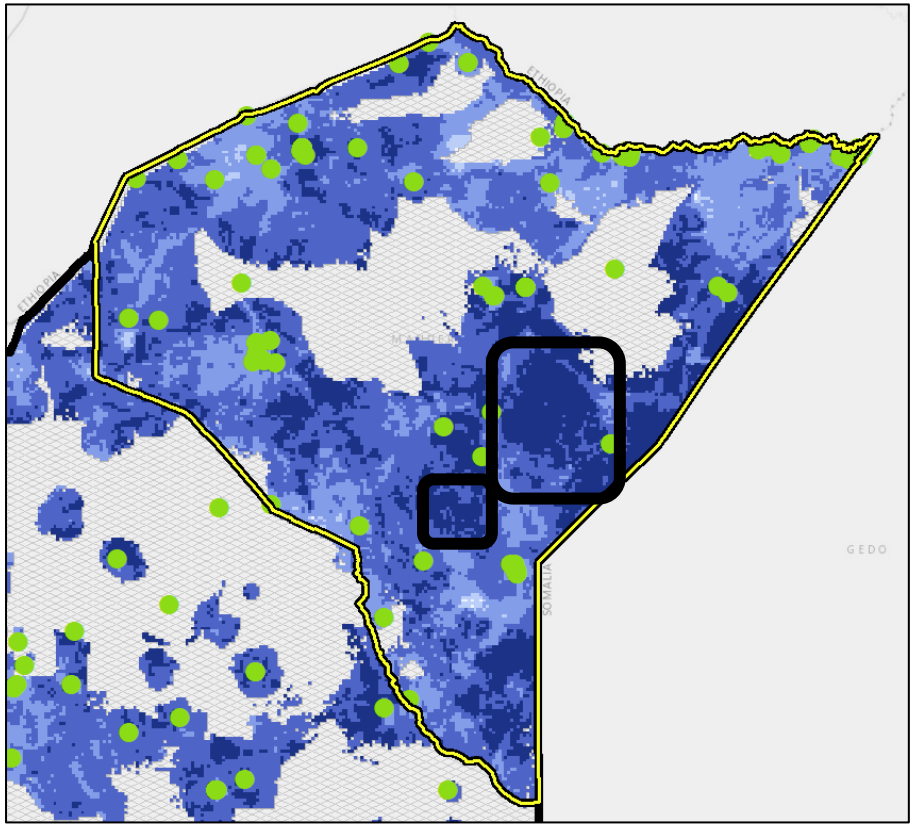
0% **60%+**

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: Health centers come from the World Health Organization.
Note 3: School data comes from the Kenya Open Data Portal. Schools include both public and private primary and secondary schools.
Source: Fraym, Kenya DHS 2014

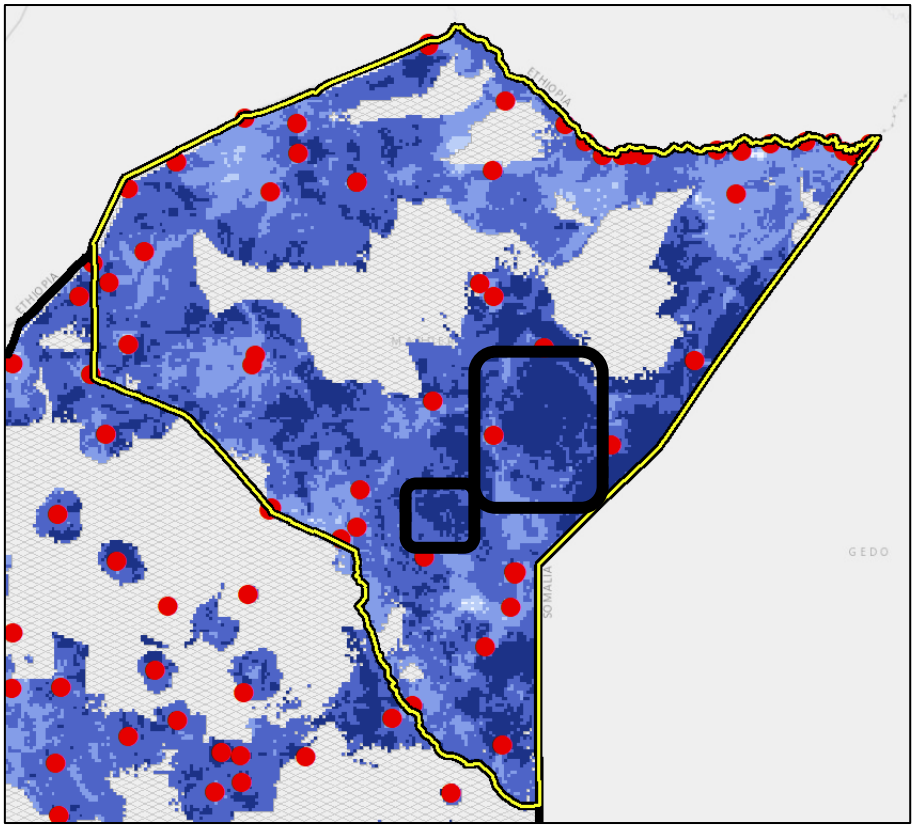
HOTSPOT ANALYSIS || MANDERA COUNTY (SCHOOLS AND CLINICS)

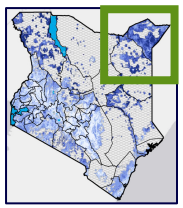
There are several high prevalence areas that appear to lack schools or health centers.

Public Primary and Secondary Schools



Public Health Centers





Under 18 Prevalence

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

0% **60%+**

Areas with total population less than 10 people per sq km

Source: Fraym, Kenya DHS 2014, Kenya Open Data Portal, WHO

HOTSPOT ANALYSIS || MANDERA COUNTY (SUB-COUNTY LEVEL DATA)

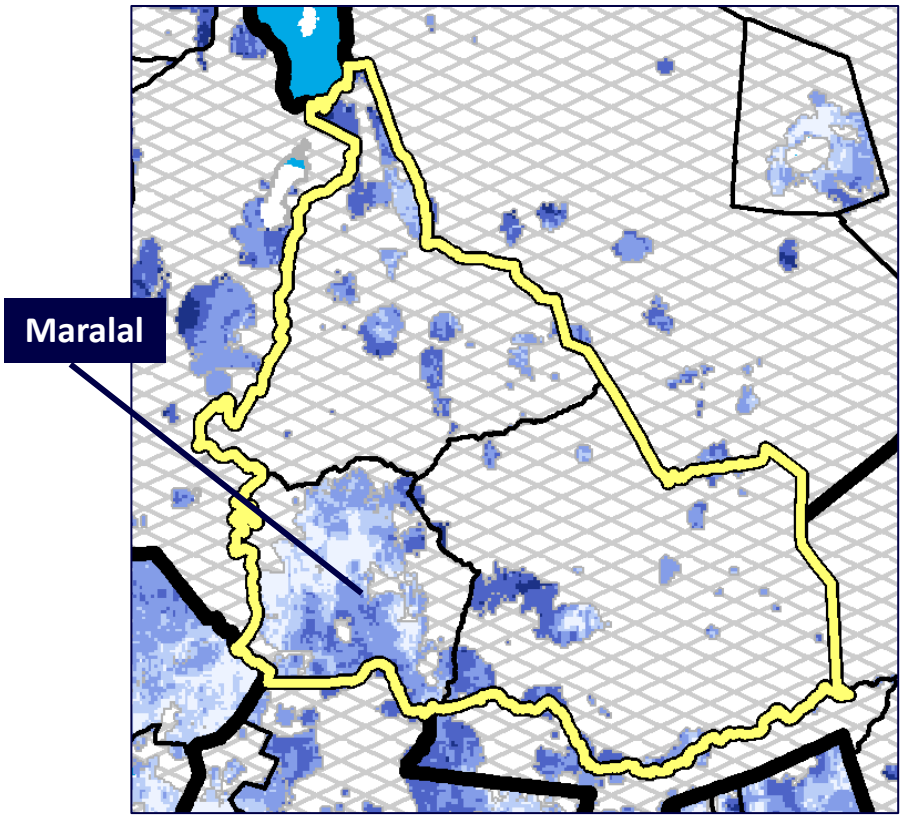
Mandera East, with the lowest under-18 prevalence rate, also has notable higher rates of female employment and female educational attainment.

Indicator	Banissa	Mandera West	Mandera North	Mandera South	Lafey	Mandera East
Child Marriage						
Under-18 Prevalence	49%	49%	47%	49%	61%	40%
Population of At-Risk Girls, by Profile						
Pregnancy	-	-	-	60	-	-
Poverty	34,200	30,750	30,600	41,000	30,500	11,450
Gender Inequitable Attitudes	1,500	450	4,700	850	4,200	400
Limited Decision-Making	33,200	34,900	25,700	24,000	27,300	18,000
Community Characteristics						
Total Population	412,800	433,400	439,300	672,000	407,700	360,200
Number of Health Centers and Schools per 100,000 people	13	10	17	37	5	62
Percent of women (aged 15-49) who are employed	12%	6%	9%	1%	6%	19%
Percent of women (aged 18-49) who completed primary education or higher	9%	8%	8%	6%	5%	18%

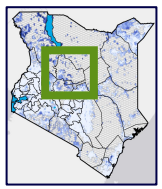
HOTSPOT ANALYSIS || SAMBURU COUNTY (OVERVIEW)

Though much of Samburu is sparsely populated, the under-15 prevalence rate is high and mainly concentrated near Lake Turkana in the north, and areas in the south.

Samburu county has the second highest under-15 prevalence rate – 20%



Key Indicators	
Under-15 Prevalence	20%
Under-15 Burden	1,900
Percent of adults (aged 15-49) who are employed	65%
Percent of women (aged 15-49) who are employed	51%
Percent of women (aged 18-49) who completed primary education or higher	29%
Percent of women (aged 15-24) who are sexually active and use a modern contraceptive method	5%
Percent of individuals in households with access to electricity	10%
Percent of individuals in households with a flush toilet	2%



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

0% **50%+**

Areas with total population less than 10 people per sq km

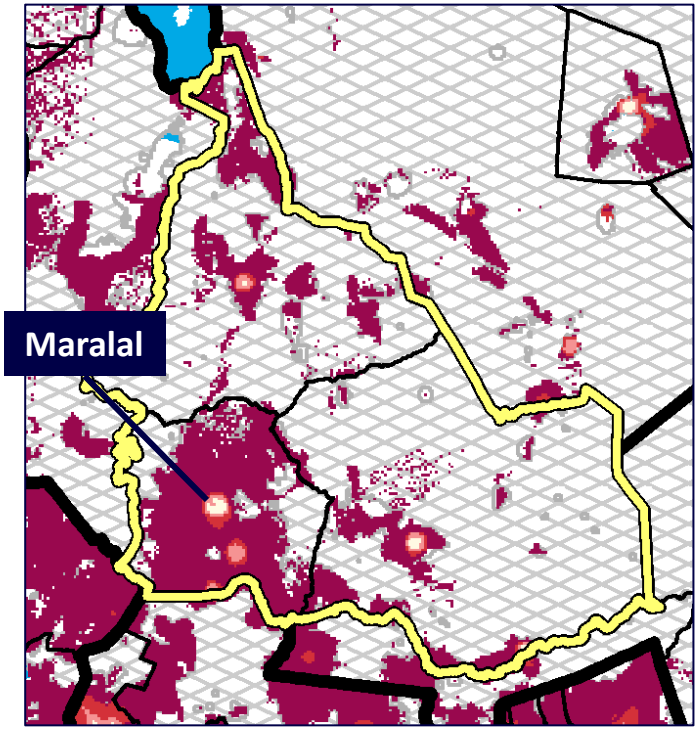
City County capital

Source: Fraym, Kenya DHS 2014

HOTSPOT ANALYSIS || SAMBURU COUNTY (RISK PROFILE MAPPING)

Most populated areas in Samburu are communities where poverty represents a high-risk factor for child marriage. There are few communities where pregnancy is a risk factor.

Poverty Index Risk Category[1]



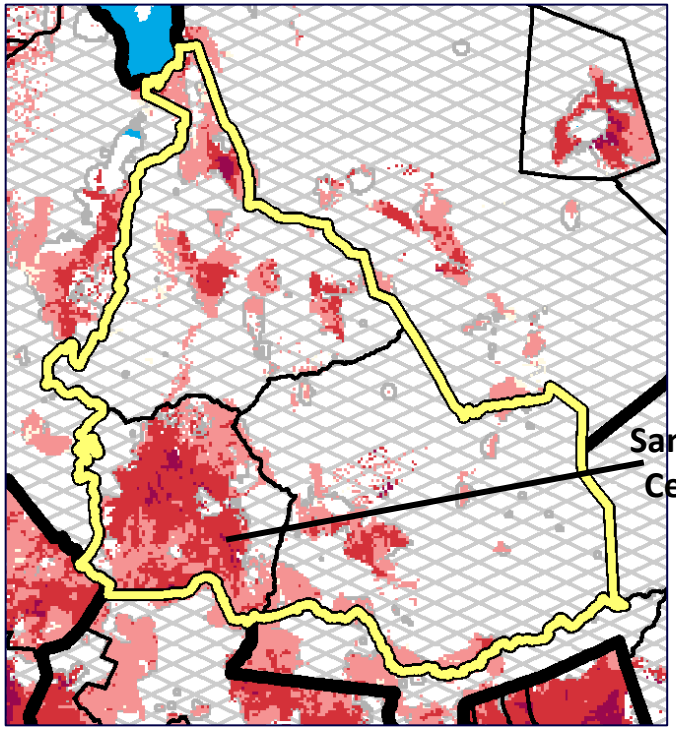
Population of at-risk girls (aged 10-14) due to poverty as a factor[3]	16,500

Low Risk
Medium-Low Risk
Medium-High Risk
High Risk

City County capital

Areas with total population less than 10 people per sq km

Pregnancy Outside of Marriage Risk Category[2]



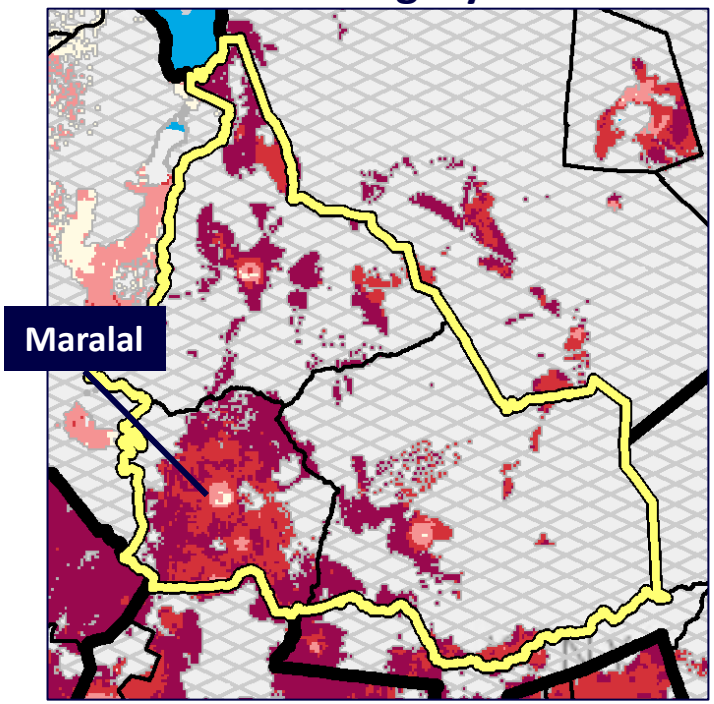
Population of at-risk girls (aged 10-14) due to pregnancy as a factor[3]	700

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 48 or the appendix for more details.
Note 2: The map shows the classification of pregnancy outside of marriage for each 1km^2 cell into quartiles. The pregnancy outside of marriage risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. See slide 42 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 a poverty index risk category or pregnancy outside of marriage risk category equal to 4 (highest risk).
Source: Fraym, Kenya DHS 2014, Worldpop 2020

HOTSPOT ANALYSIS || SAMBURU COUNTY (RISK PROFILE MAPPING)

Most populated areas in Samburu exhibit a high risk of poverty as a potential risk factor. There are few communities with a high risk of pregnancy as a factor.

Attitudes Towards Wife Beating Risk Category[1]



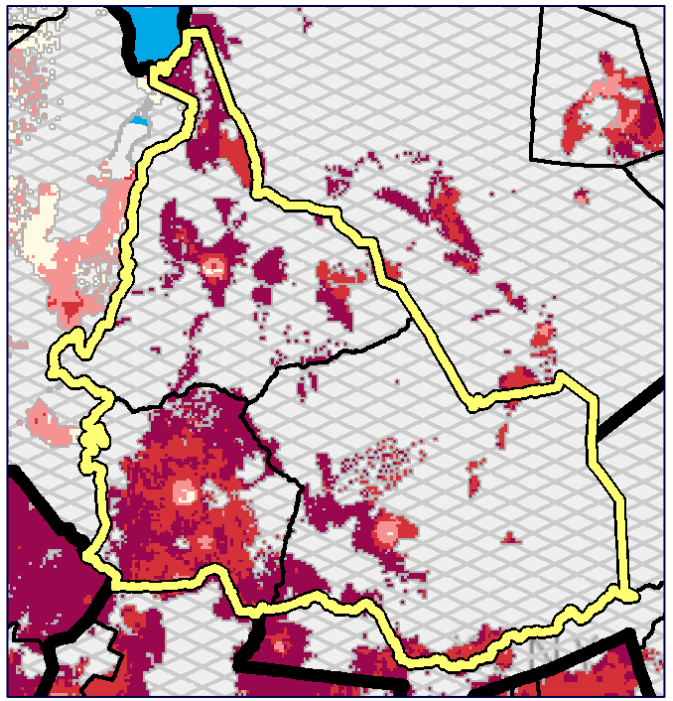
Population of at-risk girls (aged 10-14) due to attitudes as a factor[3]	12,000

Low Risk
Medium-Low Risk
Medium-High Risk
High Risk

City County capital

Areas with total population less than 10 people per sq km

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



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

Note 1: The map shows the classification of attitudes towards wife beating for each 1km^2 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 53 or the appendix for more details.

Note 2: The map shows the classification of women's participation in decision-making index for each 1km^2 cell into quartiles. The risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk. Please see slides 57-58 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, Kenya DHS 2014, Worldpop 2020

HOTSPOT ANALYSIS || SAMBURU COUNTY (INFRASTRUCTURE AND SERVICES)

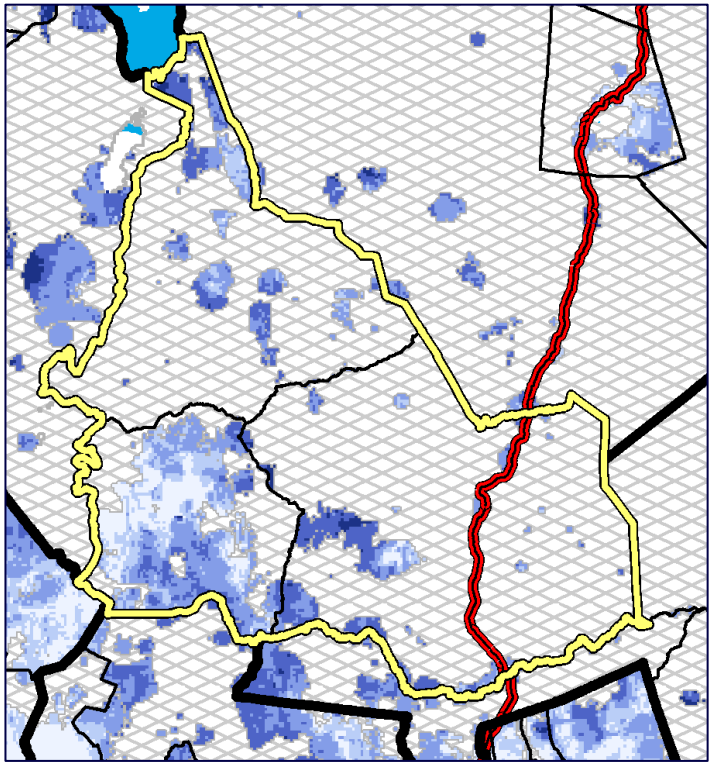
As with the other hotspot analysis counties, infrastructure appears limited in Samburu county.

1. There is a single major road that runs through the eastern portion of the county. High prevalence areas have limited transportation access.

2. There are roughly 22 public health centers per 100,000 people, which is above the national rate (11 per 100,000 people).[2]

3. There are 43 public school per 100,000 people, slightly below the national rate.[3]

Major Roads in Samburu County[1]



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

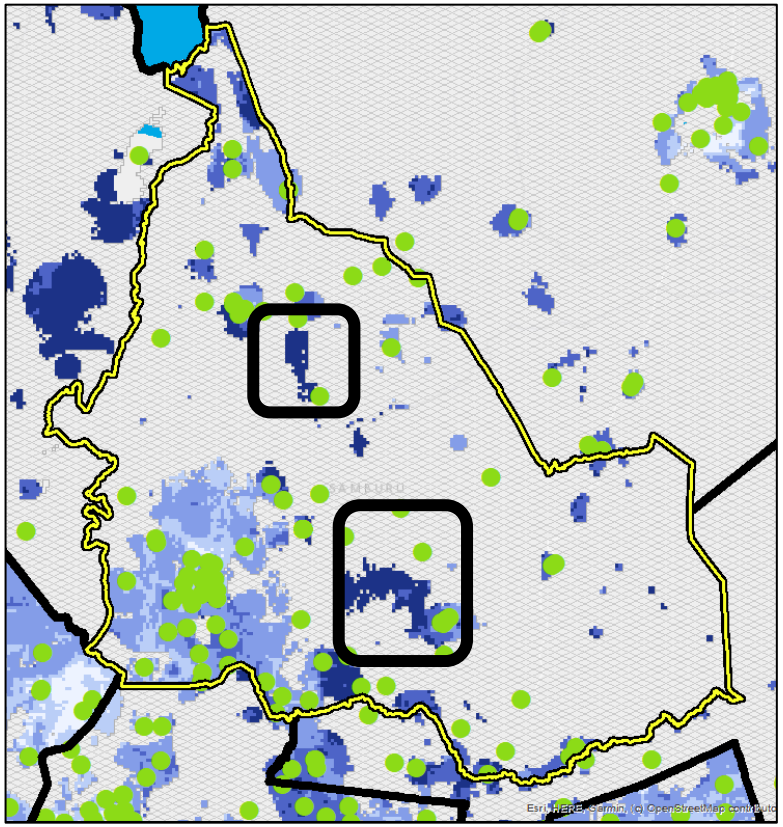
0% **50%+**

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: Health centers come from the World Health Organization.
Note 3: School data comes from the Kenya Open Data Portal. Schools include both public and private primary and secondary schools.
Source: Fraym, Kenya DHS 2014

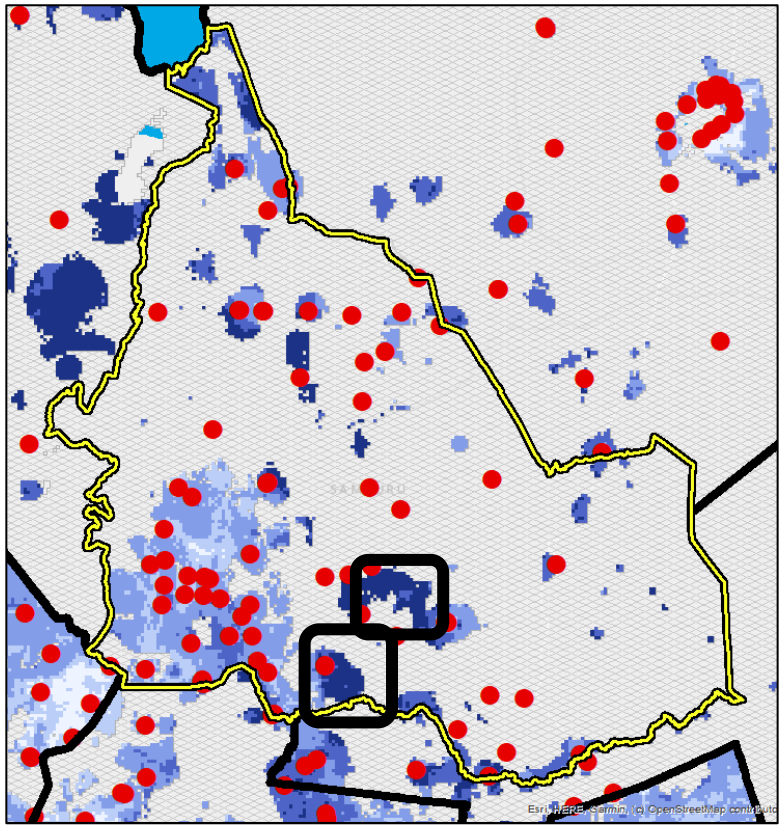
HOTSPOT ANALYSIS || SAMBURU COUNTY (SCHOOLS AND CLINICS)

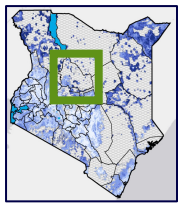
There are several high prevalence areas that appear to lack schools or health centers.

Public Primary and Secondary Schools



Public Health Centers





Under 15 Prevalence

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

0% **50%+**

Areas with total population less than 10 people per sq km

Source: Fraym, Kenya DHS 2014, Kenya Open Data Portal, WHO

HOTSPOT ANALYSIS || SAMBURU COUNTY (SUB-COUNTY LEVEL DATA)

All three sub-counties in Samburu have roughly similar (and high) under-15 prevalence rates.

Indicator	Samburu Central	Samburu North	Samburu East
Child Marriage			
Under-15 Prevalence	19%	22%	24%
Population of At-Risk Girls, by Profile			
Pregnancy	290	350	60
Poverty	7,200	5,000	4,200
Gender Inequitable Attitudes	3,700	4,600	3,700
Limited Decision-Making	3,700	3,900	2,700
Community Characteristics			
Total Population	153,700	69,300	63,300
Number of Health Centers and Schools per 100,000 people	83	21	24
Percent of women (aged 15-49) who are employed	58%	39%	43%
Percent of women (aged 18-49) who completed primary education or higher	34%	23%	22%

Appendix

I. Definitions

II. Data and Methodology

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.

Note: All indicators are from the 2014 Kenya DHS. Child marriage prevalence is also calculated using the 2009 Kenya DHS and 2003 Kenya 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 (aged 18-49) who completed at least primary school.
Male Educational Attainment	Percent of men (aged 18-49) who completed at least primary school.
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.

Note: All indicators are from the 2014 Kenya DHS. Child marriage prevalence is also calculated using the 2009 Kenya DHS and 2003 Kenya DHS.

APPENDIX | | DEFINITIONS

Indicator	Description
Risk Profiles	
Pregnancy Outside of Marriage	Pregnancy outside of marriage is defined as the percent of women aged 15 to 24 who experienced a pregnancy outside of marriage, which includes women who have given birth before marriage or up until six months after marriage. By definition, a women who experienced pregnancy outside of marriage is ever-married. Therefore, never-married women who gave birth are not considered to have experienced a pregnancy outside of marriage. The pregnancy outside of marriage risk categories range on a 1 to 4 scale, with 4 indicating the highest level of risk.
Poverty	Fraym selected four indicators to capture child marriage related poverty: (i) wealth index; (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 Participation in Decision Making	Fraym selected five indicators to assess women's participation in decision making in the household: (i) woman's health care; (ii) large household purchases; (iii) visits to family; (iv) what food should be cooked each day; (v) husband's earnings. Fraym then combined these indicators using a principal components analysis (PCA) to produce 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 2014 Kenya DHS. Child marriage prevalence is also calculated using the 2009 Kenya DHS and 2003 Kenya DHS.

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 2014 Kenya Demographic and Health Survey (DHS), 2009 DHS, and 2003 DHS.

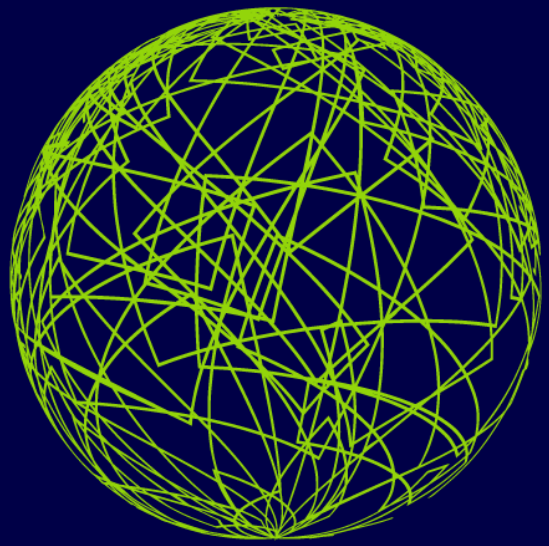
Additionally, granular population distribution data comes from WorldPop, a publicly available and detailed population distribution and composition data source that leverages existing census data to produce 100m x 100m resolution estimates of population density. In order to build its datasets, WorldPop 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 (2014, 2009, and 2003).

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 Kenya, the surveys were implemented by the National Bureau of Statistics with financial, technical, and managerial support by large **internationally respected organizations**, including the World Bank, United Kingdom Department for International Development, United Nations, and US Agency for International Development. 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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