

## Geospatial Analysis

of Vaccine Hesitancy Drivers

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VACCINATION ACCEPTANCE RESEARCH NETWORK S SABIN VACCINE INSTITUTE

## MAPPING HUMANITY

We use machine-learning to generate precise information on communities with data gaps. Our unprecedented information on human and population characteristics uncover insights that traditional data analysis can't reveal in 100+ countries down to 1km<sup>2</sup>—even in remote areas.

## About Fraym

Fraym combines survey and satellite data using advanced ML to produce population insight with 1km<sup>2</sup> resolution. We can do this in over 100 countries—including virtually any LMIC or country of interest in international development.

### **DATA CATEGORIES**

Fraym delivers enriched geospatial data on demographic, socioeconomic, and attitudinal population characteristics:

- » Age, Gender, & Race
- » Language & Religion
- » Education & Employment
- » Communications & Media
- » Energy & Infrastructure
- » Assets & Finances

- » Health, Nutrition, & WASH
- » Service Access & Demand
- » Confidence in Government
- » Vaccine Hesitancy Drivers
- » Vulnerability to Conflict, Climate Change, Diseases, Misinformation, & Violence



# Vaccine Hesitancy

Mapping hesitancy to COVID-19 vaccines in Ethiopia, Kenya, Malawi, Mali, Nigeria, Rwanda, South Africa, Uganda, and Zambia.

### VACCINE HESITANCY **Project Overview**

#### **Mapping Hesitancy**

Population indicators related to vaccine hesitancy were mapped down to the 1km<sup>2</sup> using advanced ML technology.





#### **Analyzing Drivers**

Hyperlocal indicators were used to produce geospatial models on the underlying drivers of vaccine hesitancy.

#### **DATAfraym® Dashboards**

Geospatial data deployed via web-based software requires no GIS expertise to visualize and integrate analysis into RCCE.





#### **Supporting Partners**

Data is provided to IPs, with custom support to utilize spatial data and GIS tools to inform strategy and activities.

## WHO Sage Working Group 3Cs Model

Fraym modeled levels of vaccine Confidence, Convenience, and Complacency to locate, quantify, and profile populations based on their unique drivers of vaccine hesitancy.

- **Confidence:** Trust in the effectiveness and safety of vaccines, the system that delivers them, and the motivations of policymakers.
- 2 **Convenience:** Physical availability, affordability, and willingness-to-pay, geographical accessibility, ability to understand, and appeal of immunization services.

**Complacency:** Level to which perceived risks of vaccine-preventable diseases are low and vaccination is not deemed a necessary preventative action.



Source 1: https://www.who.int/immunization/sage/meetings/2014/october/1\_Report\_WORKING\_GROUP\_vaccine\_hesitancy\_final.pdf Source 2: https://africacdc.org/download/covid-19-vaccine-perceptions-a-15-country-study/ Source 3: https://pubmed.ncbi.nlm.nih.gov/33684019/

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## **3Cs Model Framework in South Africa**



**Source 1**: Fraym nationally representative online panel of 8,028 South African adults conducted April 9-23, 2021 **Source 2**: 2020 Malaria Atlas Project "Global maps of travel time to health facilities"

## Mapping Hesitancy

Fraym calculated and mapped levels of hesitancy, segmented into very, somewhat <sup>1</sup>, and not, across South Africa to identify where and what vaccine uptake challenges were most likely to occur.



#### **Number of Somewhat Hesitant Adults**

### Districts with the Highest Number of Somewhat Hesitant Adults

District	Number of vaccine hesitant adults	% of district adult population
City of Johannesburg (Gauteng)	885,200	21%
City of Cape Town (Western Cape)	838,500	25%
Ekurhuleni (Gauteng)	660,300	25%
City of Tshwane (Gauteng)	488,000	19%
eThekwini (KwaZulu-Natal)	425,800	17%

Each 1km<sup>2</sup> pixel represents the number of adults who are unsure whether to receive the COVID-19 vaccine.

Values in areas with no population are removed.

Note 1: Fraym defines the 'somewhat hesitant' as those South Africans over the age of 18 years who do not know if they will get a COVID-19

vaccination if or when one becomes available.

## VACCINE HESITANCY National Summary

Nearly **1** in **4** South Africans report they "do not know" if they will receive the COVID-19 vaccine. Overcoming vaccine hesitancy for this *somewhat hesitant* group will be critical for reaching herd immunity and securing equitable social and economic recovery.

## **South Africa:** "Do you plan to get a COVID-19 vaccine when one becomes available?"<sup>1</sup>



### South Africa: Profile of the Somewhat Hesitant

Driven by practical considerations with questions about vaccine safety and efficacy. 38 percent are concerned of costs associated with getting the vaccine and 43 percent are concerned it will not be distributed fairly.

**Moderate trust of government's COVID-19 information.** 8 in 10 trust the government "mostly" or "a little".

**More likely to be less educated.** 45 percent completed up to secondary education and 54 percent completed higher education.

**More likely to be Black/African.** 55 percent identify as Black/African, while 29 percent identify as White. Ten percent identify as Coloured.

More likely to live in marginalized and poor communities.

**Note 1**: Given the strategic importance of the undecided, Fraym focuses this analysis on the 'somewhat hesitant,' defined as those South Africans over the age of 18 years who do not know if they will get a COVID-19 vaccination if or when one becomes available. **Source**: Fraym nationally representative online panel of 8,028 South African adults conducted April 9-23, 2021.

## Identification and Targeting

Fraym's hyper-local data uncovers neighborhood-level patterns that are critical for identification and targeting. In the greater Cape Town area, vaccine hesitancy is largely tied to socioeconomic status.



### Cape Town: Number of Somewhat Hesitant Adults<sup>1</sup>

In Cape Town, concentrations of somewhat hesitant adults are highest along the N2 highway and Cape Flats townships.

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- Primarily black, low-income neighborhoods such as Khayelitsha, Mitchells Plain, Nyanga, Langa, Bishop Lavis, and Steenburg have the highest concentrations of somewhat hesitant adults.
- 3 Wealthier areas such as **Camps Bay**, **Hout Bay**, and **Constantia** have much lower concentrations of somewhat hesitant adults.

**Note 1**: Fraym defines the 'somewhat hesitant' as those South Africans over the age of 18 years who do not know if they will get a COVID-19 vaccination if or when one becomes available.

### **VACCINE HESITANCY**

## **Demographic Characteristics**

**Somewhat hesitant** individuals are less likely to be male, Black/African, and be in the high-income classes as compared to **not hesitant** individuals.

	Demographics	Not Hesitant	Somewhat Hesitant	Very Hesitant	All Adults		
	Gender						
	Females	49%	54%	52%	51%		
<b>ŦT</b>	Male	51% *	45%	47%	49%		
• •	Age						
1 <b>* *</b>	18-34	48%	47%	44%	47%		
	35-64	44%	46%	49%*	46%		
•	Race						
~ ~	Black/African	65%***	55%***	46%***	58%		
۲ă	White	22%***	29%***	40%***	28%		
	Coloured/Indian	13%	15% *	12%	13%		
		М	arital Status				
Å Å	Single	48%	47%	41%***	46%		
Π 👚	Married	32%	31%	35%	33%		
	Annual Income						
	Under R10,000	30%	30%	27%	29%		
	Between R10,000 – R39,000	21%	21%	21%	21%		
	Between R40,000 – R99,000	11%	12%	11%	11%		
	More than R100,000	30%	25%***	31%	29%		

Note 1: Categories may not sum to 100 percent due to response options that are not shown.

Note 2: Statistically significant differences across groups at the 90% level are marked with \*, at the 95% level with \*\*, and at the 99% level with \*\*\*.

## Effective Campaigns

The **somewhat hesitant** are best reached by **social media**, but campaigns should be tailored to reflect varying media outlet consumption based on demographics and location.

		Overall Population	Black / African	Black /African in Western Cape
Social Media	Facebook	85%	88%	87%
	Twitter	36%	45%	42%
	Instagram	47%	50%	53%
	WhatsApp	94%	93%	93%
	YouTube	75%	74%	86%
	News 24	56%	60%	64%
Newspapers	The Sowetan	16%	25%	16%
	Mail & Guardian	12%	15%	11%
	Cape Argus	4%	3%	23%
	Do not read any newspapers/news agencies	31%	27%	28%
	Metro FM	31%	46%	70%
	Ukhozl FM	14%	24%	4%
Radio	Jacaranda FM	17%	9%	2%
	Umhlobo Wenene FM (UWFM)	8%	14%	46%
	Do not listen to radio stations/shows	19%	16%	15%
Television	SABC 1	46%	71%	75%
	SABC 2	38%	47%	56%
	e.TV	51%	59%	72%
	Do not watch TV	16%	10%	3%

Cape Town: Number of the somewhat hesitant<sup>1</sup>

- 1 A large percentage of somewhat hesitant individuals do not consume any traditional media (newspapers, radio, or television).
- 2 South Africa's Black/African population is more likely to use **Twitter**, read the **Sowetan**, listen to **Metro FM**, and watch **SABC 1** than the broader population.

The Black/African population living in Western Cape is more likely to watch **YouTube**, read **Cape Argus**, listen to **UWFM**, and watch **e.TV** than the Black/African population in the rest of the country.

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**Note 1**: Fraym defines the 'somewhat hesitant' as those South Africans over the age of 18 years who do not know if they will get a COVID-19 vaccination if or when one becomes available.

## Mapping the 3Cs

Fraym created an index of the 3Cs, divided them into low, medium, and high terciles, and mapped each index and tercile down to the 1km<sup>2</sup> to segment hesitancy drivers.

For example, Low Vaccine Convenience is most prevalent in the east, with proportions highest in rural areas far from urban centers.





**Note:** This map shows the percentage of adults 18+ who have low convenience for getting a Covid-19 vaccine at the 1km<sup>2</sup> level. Each grid cell represents the total percentage of adults who are low convenience, based on the overall convenience index. **Source:** Fraym nationally representative online panel of 8,028 South African adults conducted April 9-23, 2021.

### VACCINE HESITANCY

## **Use Case: Hard-to-Reach Communities**

Z F Mgcawu district has a high number of individuals with High Confidence but Low Convenience and Low Complacency – TV may be a good medium for messaging.

#### TV Viewership in Z F Mgcawu in the Past 7 Days

TV Station	Proportion of Adults	Number of Adults
SABC2	57%	96,000
ETV	53%	88,000
Mzansi Magic	50%	84,500
SABC1	50%	84,000
CNN	49%	82,000
Channel 0	46%	77,000
SABC3	46%	77,000
MNET Action	44%	73,000



Proportion of adults 18+ that watch SABC1

0%

60%

## VACCINE HESITANCY Use Case: DATAfraym®

Use web-based tools to connect population segments, such as the vaccine hesitant due to convenience factors, with social and traditional media channels to target RCCE.



### VACCINE HESITANCY Key Takeaways

Calculate and map to the 1km<sup>2</sup> the underlying drivers of vaccine hesitancy in any geography, using existing or tailored survey data, enhanced by machine learning.



Segment populations by demographic, socioeconomic, and attitudinal characteristics and target the most vulnerable by their access to different media channels.



Support RCCE strategies and messaging by providing implementing partners access to data, analysis, and technical expertise via the web-based DATAfraym® tool.





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