

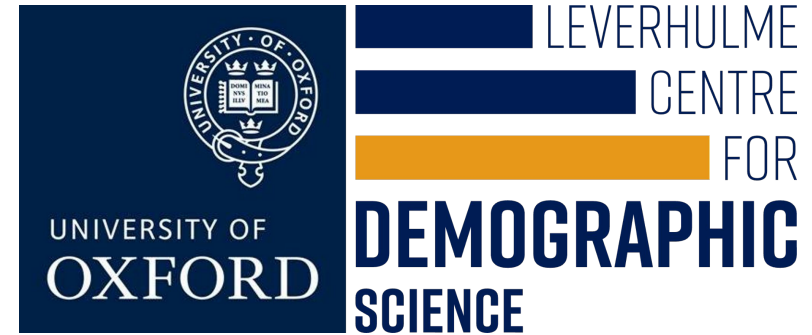
# Ukraine Crisis:

## Monitoring population displacement through social media activity

**Doug Leasure**  
Leverhulme Centre for Demographic Science  
University of Oxford

SICSS-Oxford

6 July 2022



LONDON  
SCHOOL of  
HYGIENE  
& TROPICAL  
MEDICINE



QCRI  
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Qatar Computing Research Institute  
جامعة حمد بن خليفة  
HAMAD BIN KHALIFA UNIVERSITY



# Facebook Marketing API

A tool for advertisers to measure audience sizes and demographics for targeted advertisements



New Reach Campaign > New Reach Ad Set > 1 Ad

In draft

Edit Review

Nigeria

Nigeria

Include Search locations Browse

Age

18 65+

Gender

All  Men  Women

Detailed targeting

Close All edits saved

Audience definition

Your audience selection is fairly broad.

Specific Broad

Estimated audience size: 18,200,000 - 21,400,000

Estimates may vary significantly over time based on your targeting selections and available data.

Estimated daily results

Reach

42K - 120K

The accuracy of estimates is based on factors like past campaign data, the budget you entered, market data, targeting criteria and ad placements. Numbers are provided to give you an idea of performance for your budget, but are only estimates and don't guarantee results.

Back Next

Navigation sidebar with icons for Home, Menu, Profile, Ad Creation, Analytics, and Settings. The main menu is expanded to show:

- New Reach Campaign
- New Reach Ad Set
- advert
- + Create ad set

Facebook Ads Manager interface for a "New Reach Ad Set".

Location selection: Nigeria

Map showing Nigeria and surrounding regions (BURKINA FASO, BENIN, TOGO, GHANA, CAMEROON). Major cities like Niamey, Kano, N'Djamena, Tamale, Lagos, Accra, and Port Harcourt are labeled.

Targeting filters:

- Age: 18 - 65+
- Gender:  All,  Men,  Women

Buttons: Edit, Review, Close, All edits saved

Summary and performance metrics for the ad set.

Status: In draft

### Audience definition

Your audience selection is fairly broad.

Specific  Broad

Estimated audience size: 12,100,000 - 14,300,000 ⓘ

Estimates may vary significantly over time based on your targeting selections and available data.

### Estimated daily results

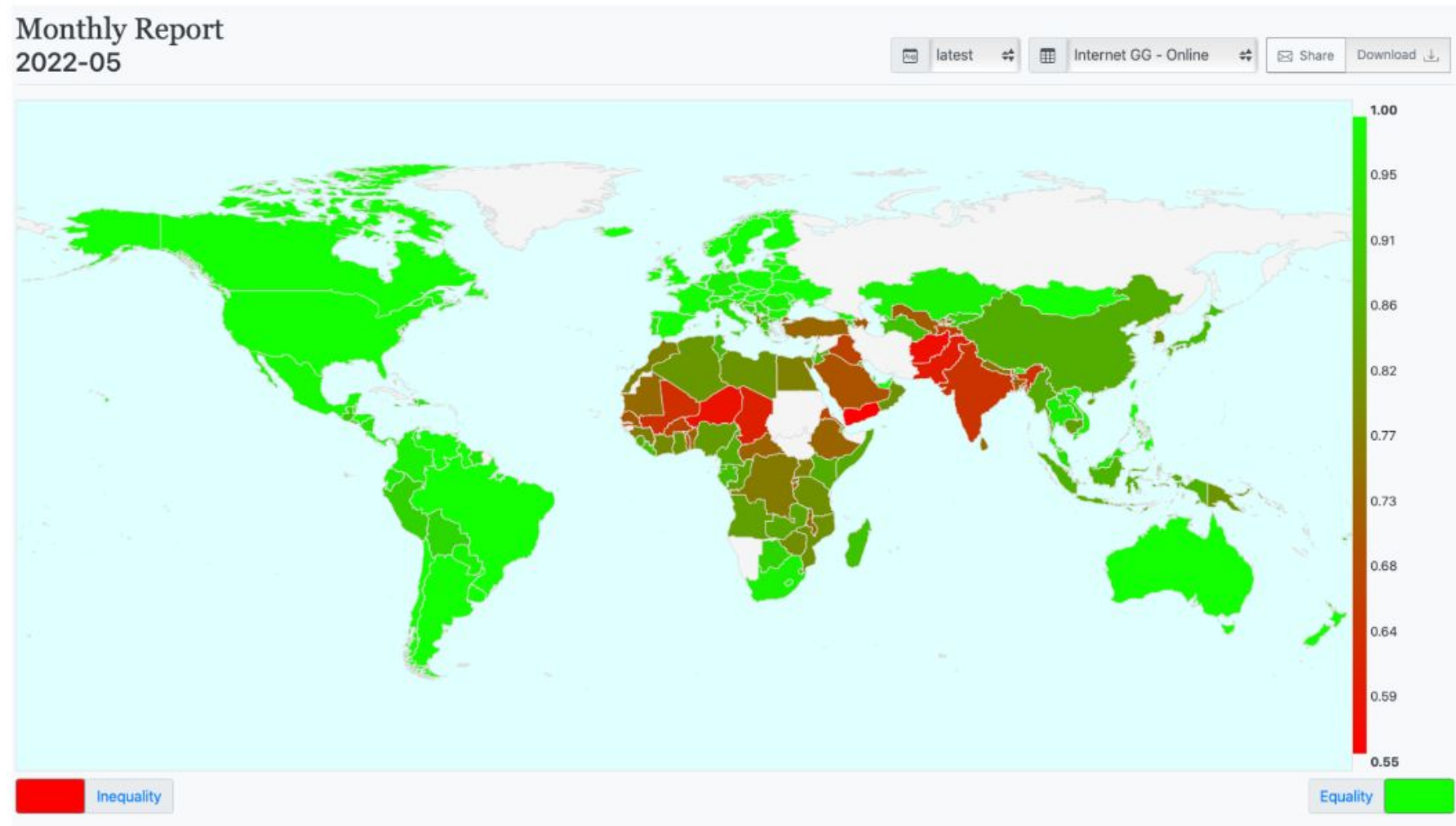
Reach ⓘ

**40K - 114K**

The accuracy of estimates is based on factors like past campaign data, the budget you entered, market data, targeting criteria and ad placements. Numbers are provided to give you an idea of performance for your budget, but are only estimates and don't guarantee results.

Buttons: Back, Next

# Nowcasting Digital Gender Gaps



[www.digitalgendergaps.org](http://www.digitalgendergaps.org)

Fatehkia M, Kashyap R, Weber I. 2018. Using Facebook ad data to track the global digital gender gap. *World Development* 107: 189-209.

# Facebook Marketing API



## Request

- Location (*e.g. Kyiv, Ukraine*)
- Sex
- Age
- Language



## Response

- Counts of daily active users
- Counts of monthly active users



# http requests

- Request-response protocol between a client computer (e.g. you) and a server (e.g. Facebook)
- Methods
  - GET or POST requests
- Implementation
  - R package: *httr*
  - Python package: *requests*
  - Command line: *curl*

Example **http GET** request from your browser:

<https://www.google.com/search?q=puppies>

# Facebook Marketing API

You need:

1. Facebook account
2. Marketing app with a ***token*** and an ***ad account number***

[https://github.com/ridhi-kashyap/SICSS\\_Digital\\_Trace\\_2022/blob/main/Steps\\_for\\_creating\\_FB\\_Access\\_Token.pdf](https://github.com/ridhi-kashyap/SICSS_Digital_Trace_2022/blob/main/Steps_for_creating_FB_Access_Token.pdf)

Additional Resources:

<https://developers.facebook.com/docs/marketing-api/audiences/reference/basic-targeting>

<https://developers.facebook.com/docs/marketing-api/audiences/reference/targeting-search>



# API Query from R

```
#Loading required packages
library(readr)
library(dplyr)
library(jsonlite)
library(httr)

#Specify version of the API
version <- "v13.0"

#Specify your authentication/credentials,
#these should be saved separately in a private file

credential<-read.csv("credentials.csv",header = FALSE)

token <- credential$V1
act <- credential$V2

#We specify the basic URL as a string
Credentials <- paste0('https://graph.facebook.com/',version,'/act_',act,'/delivery_estimate?access_token=',token)
```

# API Query from R

```
targeting_spec_simple <- '{"geo_locations":{"countries":["GB"]}}'  
  
query_char <- list(  
  include_headers="false",  
  method="get",  
  optimization_goal="REACH",  
  suppress_http_code=1,  
  targeting_spec = targeting_spec_simple)
```

Targeting: Total audience size in Great Britain (country="GB")

# API Query from R

```
query_vall <- GET(url = Credentials, query = query_char) %>% content(as="text",encoding = "UTF-8") %>% fromJSON
query_vall<-query_vall$data
query_vall
```

```
##   daily_outcomes_curve estimate_dau estimate_mau_lower_bound
## 1           0, 0, 0, 0      46394479           45500000
##   estimate_mau_upper_bound estimate_ready
## 1           53600000           TRUE
```

```
#The query provides three counts - 1. estimated daily active users (dau)
#                                     two monthly active user
#                                     2. mau_upper_bound
#                                     3. mau_lower_bound
```

```
query_vall$estimate_dau
```

```
## [1] 46394479
```

```
query_vall$estimate_mau_lower_bound
```

```
## [1] 45500000
```

```
query_vall$estimate_mau_upper_bound
```

```
## [1] 53600000
```

# API Query from R

```
{
  "data": [
    {
      "daily_outcomes_curve": [
        {
          "spend": 0,
          "reach": 0,
          "impressions": 0,
          "actions": 0
        }
      ],
      "estimate_dau": 46394479,
      "estimate_mau_lower_bound": 45500000,
      "estimate_mau_upper_bound": 53600000,
      "estimate_ready": true
    }
  ]
}
```

# API Query from R

```
target_query <- paste0('{"age_min":',age_min,  
                        ', "age_max":',age_max,  
                        ', "genders":[' ,genders, ']',  
                        ', "geo_locations":{"countries":[' ,countries, '], "location_types":["home", "recent  
" ]}]})
```

**Let's put it into practice...**

# Ukraine Crisis: February 24, 2022





# Objectives

Can we quantify internally displaced populations in Ukraine using daily Facebook marketing data?

Produce daily sub-national population estimates inside Ukraine disaggregated by age and sex.

Help fill critical data gaps to inform humanitarian response efforts.

# Methods

# SocArXiv Pre-print

## Executive Summary

Introduction

Methods

Results

Discussion

Acknowledgements

License

References

Supplementary Material

## Ukraine Crisis: Monitoring population displacement through social media activity

2022-05-30

Douglas R. Leasure<sup>1,3,6,\*</sup>, Ridhi Kashyap<sup>1,3</sup>, Francesco Rampazzo<sup>2,1,3</sup>, Benjamin Elbers<sup>3,1</sup>, Claire Dooley<sup>4,6</sup>, Ingmar Weber<sup>5</sup>, Masoomali Fatehkiya<sup>5</sup>, Maksym Bondarenko<sup>6</sup>, Mark Verhagen<sup>1</sup>, Arun Frey<sup>1</sup>, Jiani Yan<sup>1</sup>, Evelina T. Akimova<sup>1</sup>, Robert Trigwell<sup>7</sup>, Brian McDonald<sup>7</sup>, Mohamed Bakr<sup>7</sup>, Alessandro Sorichetta<sup>6</sup>, Andrew J. Tatem<sup>6</sup>, Melinda C. Mills<sup>1,3</sup>

<sup>1</sup> Leverhulme Centre for Demographic Science, Department of Sociology, University of Oxford

<sup>2</sup> Saïd Business School, University of Oxford

<sup>3</sup> Nuffield College, University of Oxford

<sup>4</sup> Department of Population Health, London School of Hygiene and Tropical Medicine

<sup>5</sup> Qatar Computing Research Institute, Hamad bin Khalifa University

<sup>6</sup> WorldPop, University of Southampton

<sup>7</sup> International Organization for Migration, United Nations

\* [douglas.leasure@sociology.ox.ac.uk](mailto:douglas.leasure@sociology.ox.ac.uk)

**Note:** This analysis is a rapid-response effort that has not yet undergone peer-review. All results are provisional and should be interpreted with caution. Version updates will be provided as potential issues are identified, methods are improved, or new data become available.



<https://doi.org/10.31235/osf.io/6j9wq>

# Source Data

1. Baseline population sizes (Bondarenko et al 2022)
2. Daily refugee counts (UNHCR 2022)
3. Daily Facebook user counts

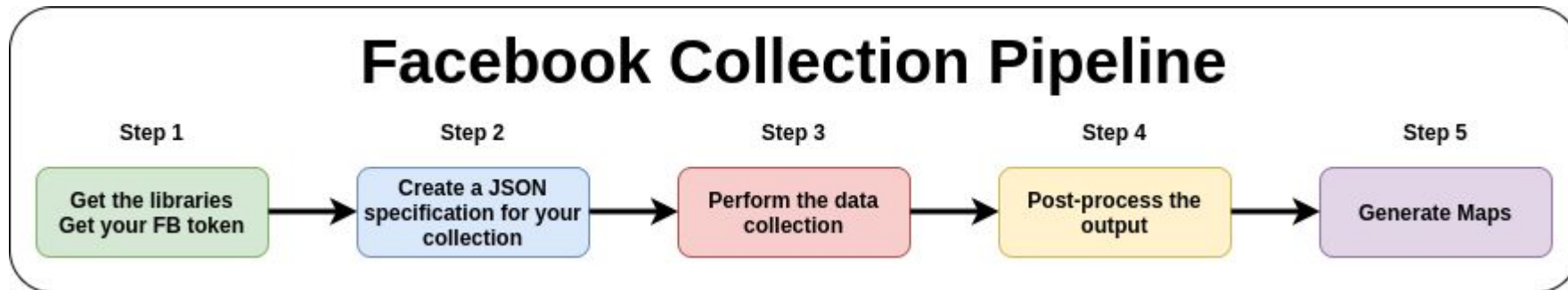
Bondarenko et al. 2022 Gridded population estimates for Ukraine using UN COD-PS estimates 2020, version 2.0. WorldPop and DLR, University of Southampton. <http://doi.org/10.5258/SOTON/WP00735>

UNHCR. Operational Data Portal. <https://data2.unhcr.org/en/situations/ukraine>

# Daily Facebook user counts



**THE WORLD BANK**



[https://worldbank.github.io/connectivity\\_mapping/facebook\\_nbs/pipeline.htm](https://worldbank.github.io/connectivity_mapping/facebook_nbs/pipeline.htm)

# pySocialWatcher software

*(Araujo, Mejova, Weber, Benevenuto 2017)*

Open-source Python package to help automate data collections from the Facebook marketing API.

<https://github.com/joaopalotti/pySocialWatcher>

# Specify Facebook users to query

## Demographics:

- **Sex:** Females, males, and all
- **Age:** 5- and 10-year age groups from 20 years old to 65+
- **Language:** All, Ukrainian, and Russian



# Specify Facebook users to query

## Locations

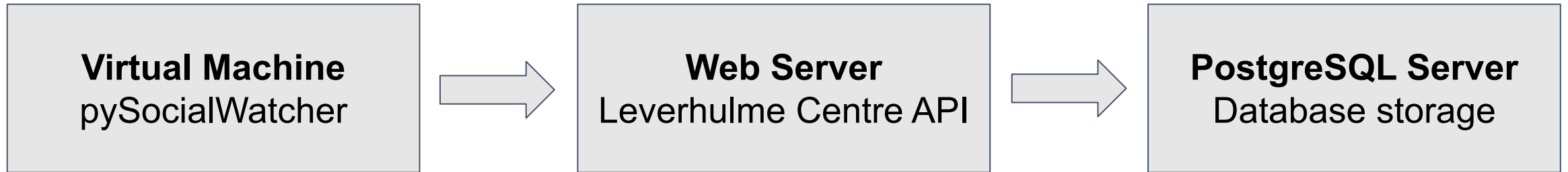
- **Countries:** Ukraine, neighbors, and European Union
- **Sub-national:** Administrative units within Ukraine and neighbors
- **Cities:** Selection within Ukraine and neighbors

# Specify Facebook users to query

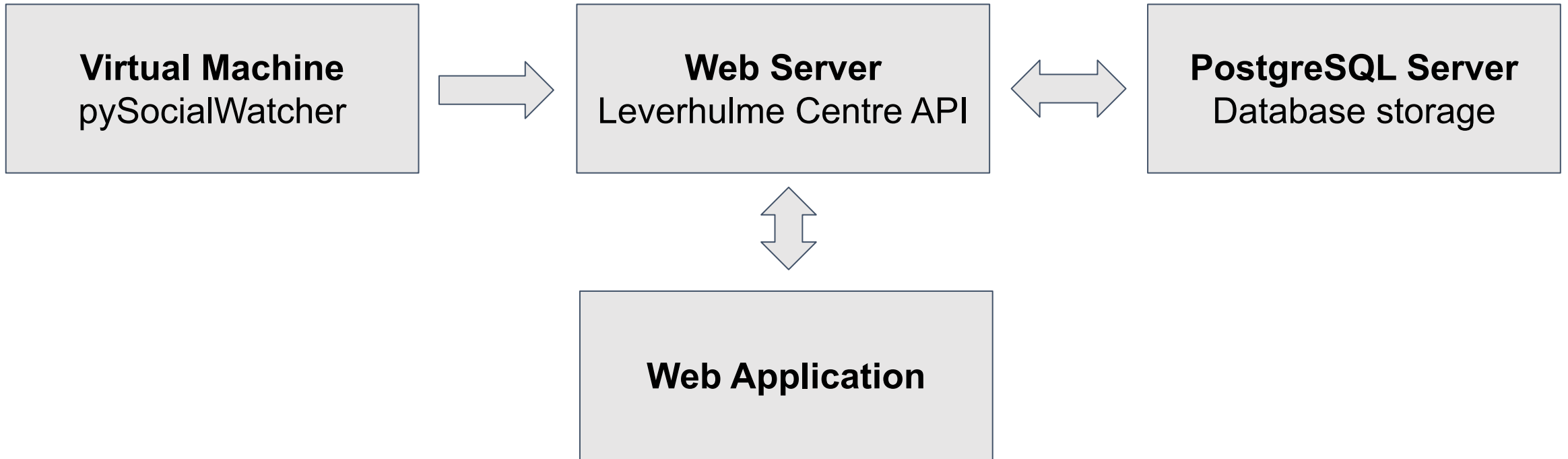
## Location types:

- **\*Recent:** Location determined by Meta from users' device data such as GPS, IP address, etc.
- **Home:** "Current city" from Facebook profile
- **Travel\_in:** Users whose recent location is more than 100 miles from their home location.

# Continuous daily data collections



# Visualize data in near real-time



# Population Estimation

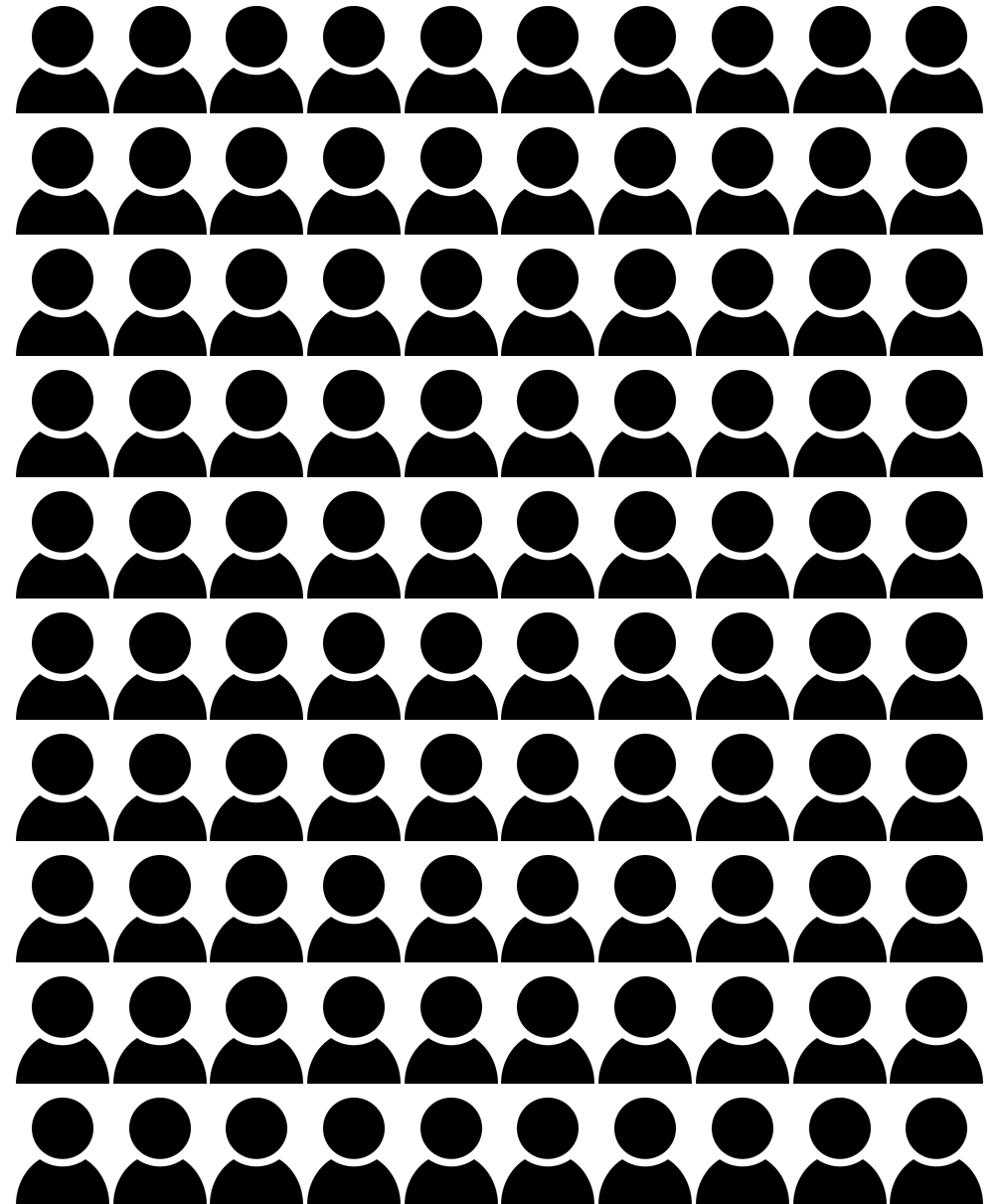
# Population Estimation

*30-34 year old women  
in Kyiv before the conflict*

# Population Estimation

*30-34 year old women  
in Kyiv before the conflict*

Baseline population = 100



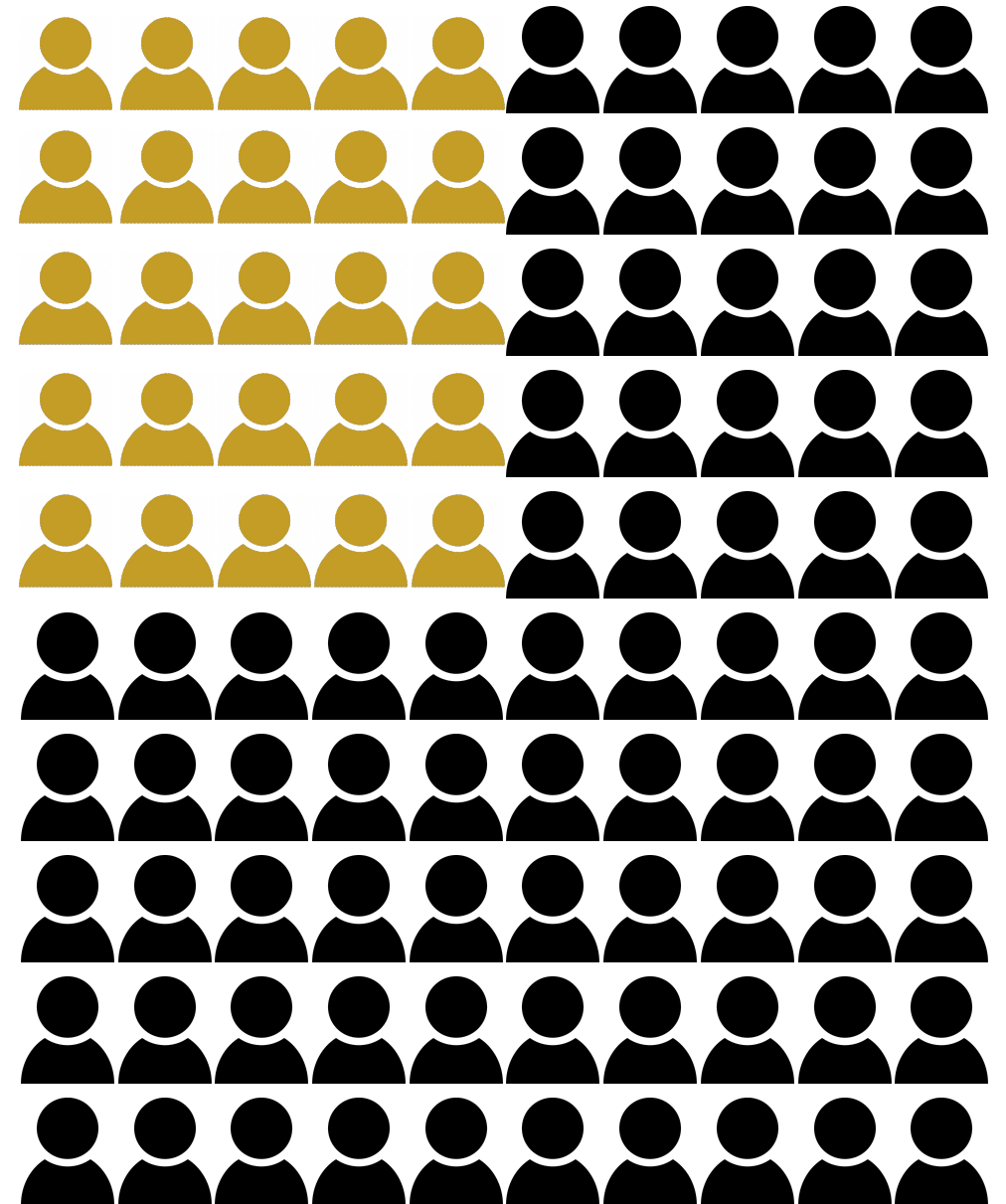


# Population Estimation

*30-34 year old women  
in Kyiv before the conflict*

Baseline population = 100

Baseline Facebook users = 25



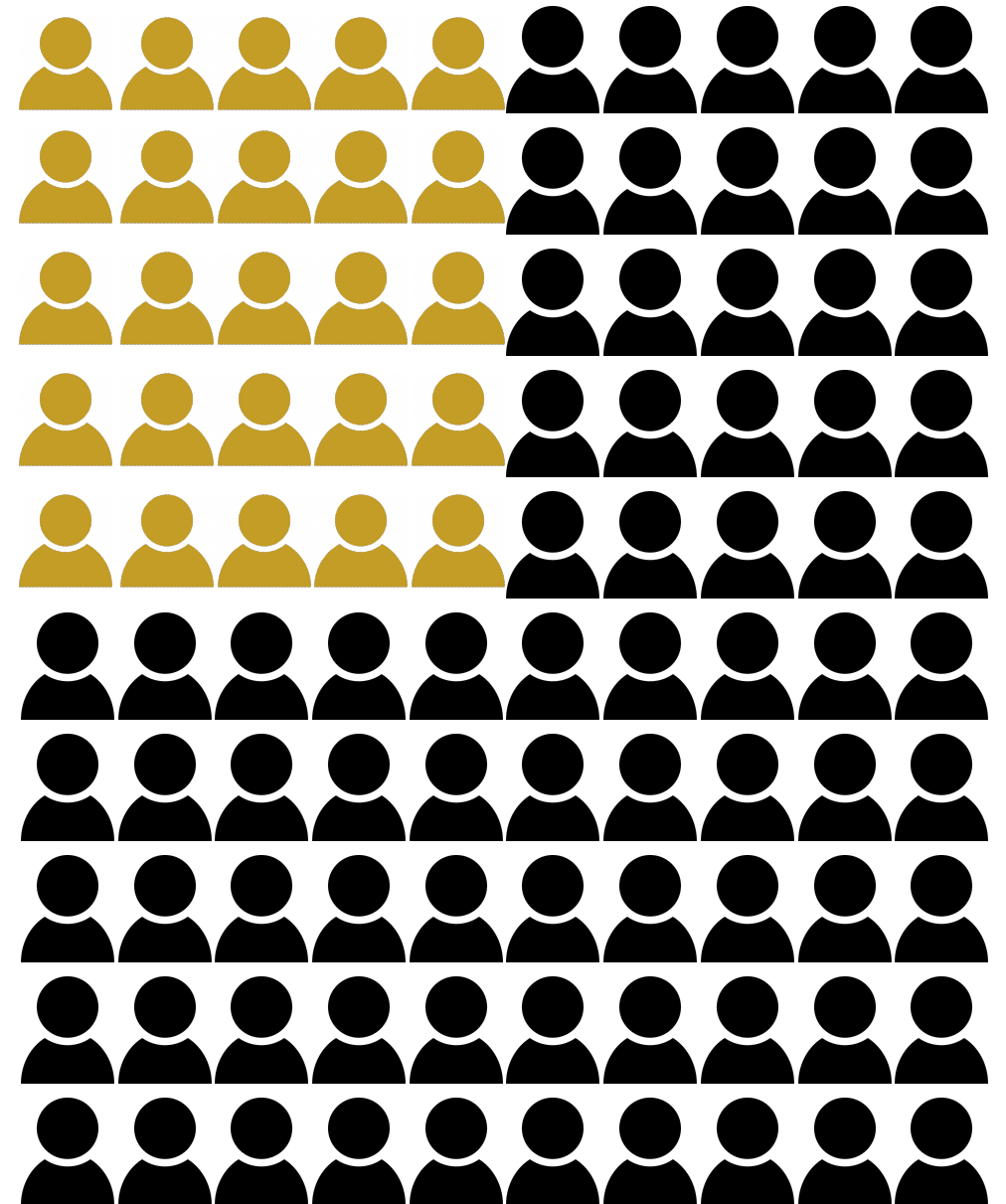
# Population Estimation

*30-34 year old women  
in Kyiv before the conflict*

Baseline population = 100

Baseline Facebook users = 25

Baseline Facebook penetration = 25%



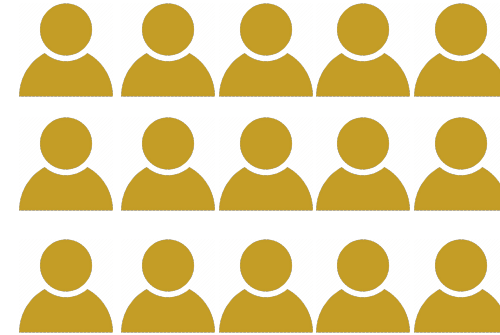
# Population Estimation

*How many 30-34 year old women  
are in Kyiv **today**?*

**POPULATION = USERS / PENETRATION**

# Population Estimation

*How many 30-34 year old women are in Kyiv **today**?*

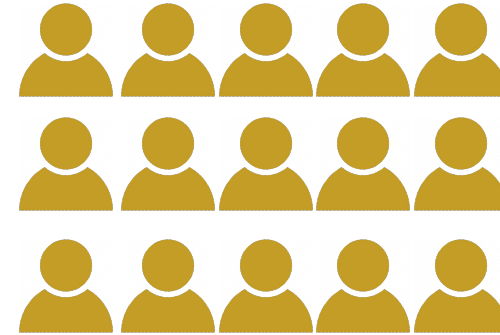


Current Facebook users = 15

$$\text{POPULATION} = \text{USERS} / \text{PENETRATION}$$

# Population Estimation

*How many 30-34 year old women are in Kyiv **today**?*



Current Facebook users = 15

*Baseline Facebook penetration = 25%*

$$\text{POPULATION} = \text{USERS} / \text{PENETRATION}$$

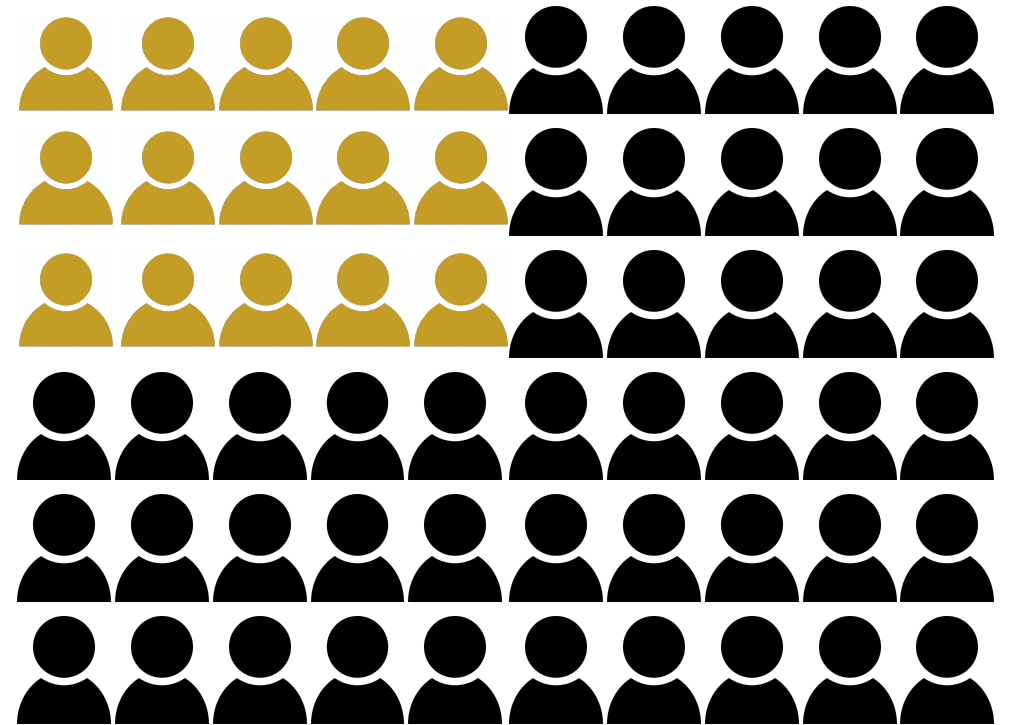
# Population Estimation

*How many 30-34 year old women are in Kyiv today?*

Current Facebook users = 15

*Baseline* Facebook penetration = 25%

Current population =  $15 / 0.25 = 60$



**POPULATION = USERS / PENETRATION**

# Non-stationary Facebook penetration rates

Facebook penetration rates have changed due to the conflict.

This would cause under- or over-estimates of *total national population*.

# Non-stationary Facebook penetration rates

The sum of our population estimates nationally should equal the baseline population minus refugees.

We apply a daily scaling factor  $X$  to ensure population estimates sum to the correct national total:

$$\text{POPULATION ESTIMATE} * X = \text{BASELINE POPULATION} - \text{REFUGEES}$$



# Under-20 Populations

- Ukraine has very few Facebook users under 20 years old
- Facebook has no users under 13 years old

We infer under-20's using baseline age-sex proportions, assuming:  
**child populations are proportional to women of reproductive age**

# Results

June 21, 2022



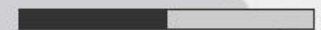
Oblast Populations



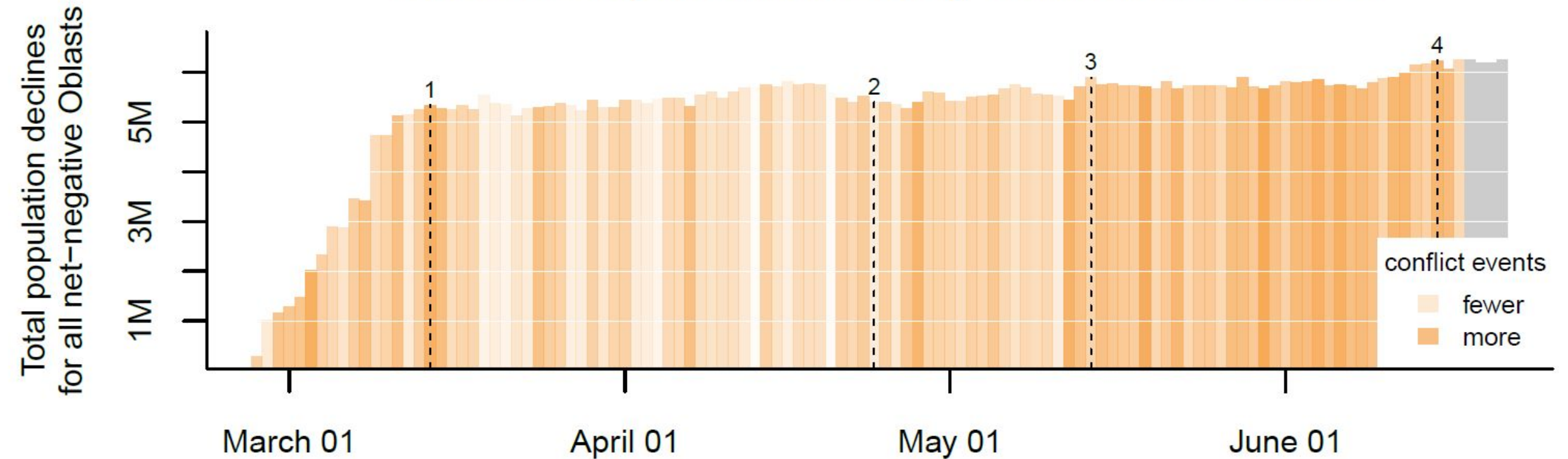
Avtonomna Respublika Krym

Sevastopilska

0 100 200 km



# Internal displacement away from home Oblast



## 1. Initial evacuation

Internally displaced

5.3m by March 14<sup>th</sup>

6.2m by June 21<sup>st</sup>

## 2. Easter Sunday

- 480k people went home

- Displacement declined across 80% of Oblast

## 3. Kherson Evacuations

- 500k people left but returned a few days later

## 4. Kherson Evacuations

- 500 k people left again



April 22, 2022  
6:41 PM GMT+1  
Last Updated 2 months ago

World

# Ukrainians return home from Poland for special Easter

By Joanna Plucinska and Kuba Stezycki

4 minute read



CNN World Africa Americas Asia Australia More

## Ukrainians celebrate Easter in the shadow of war



By Lauren Said-Moorhouse, Isa Soares, Madalena Araujo, Sofiya Harbuziuk, Oleksandra Ochman and Marc Seeman, CNN

Updated 0628 GMT (1428 HKT) April 24, 2022



Ukrainians gather for Easter in the shadow of war 03:00

May 28, 2022  
6:01 PM GMT+1  
Last Updated a month ago

Europe

# Pro-Moscow Kherson official sees decision 'towards next year' on joining Russia

By Felix Light

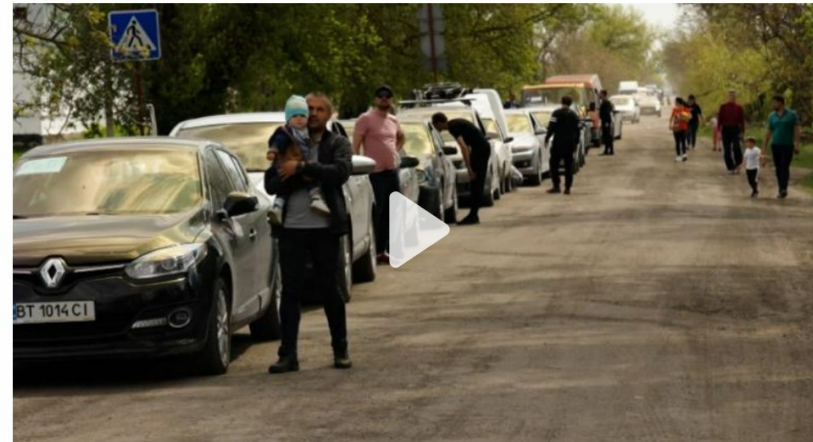
CNN World Africa Americas Asia Australia More

Audio Liv

## Days-long roadblocks, missiles and 'lots of blood.' Civilians recall terrifying attempts to escape Ukraine's cities as Russian forces tighten grip

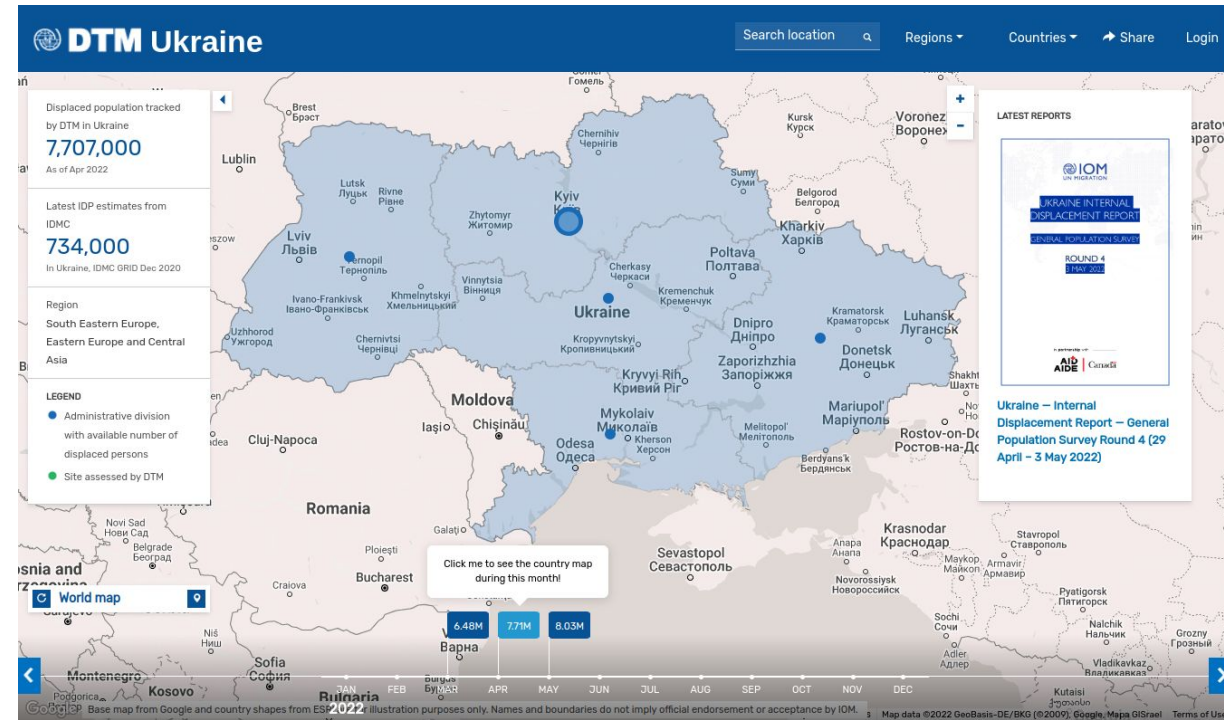
By Tim Lister and Sanyo Fylyppov, CNN

Updated 0755 GMT (1555 HKT) May 21, 2022





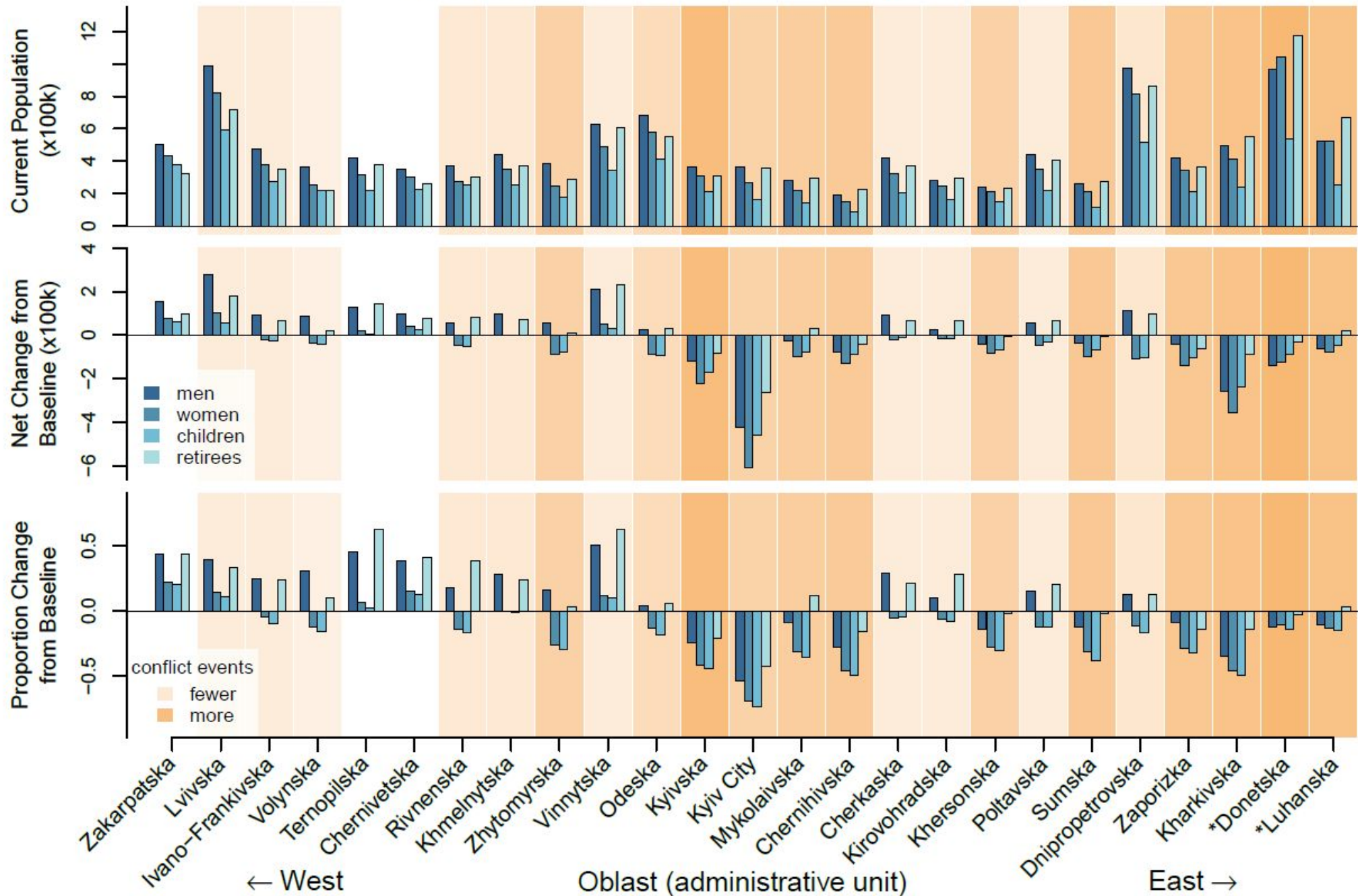
- Estimate IDPs using telephone surveys with 2,000 respondents per survey round.
- Used our population estimates as “triangulation data”.
- Helped revise official IDP estimate in early March from 1.5 million to 6.5 million.



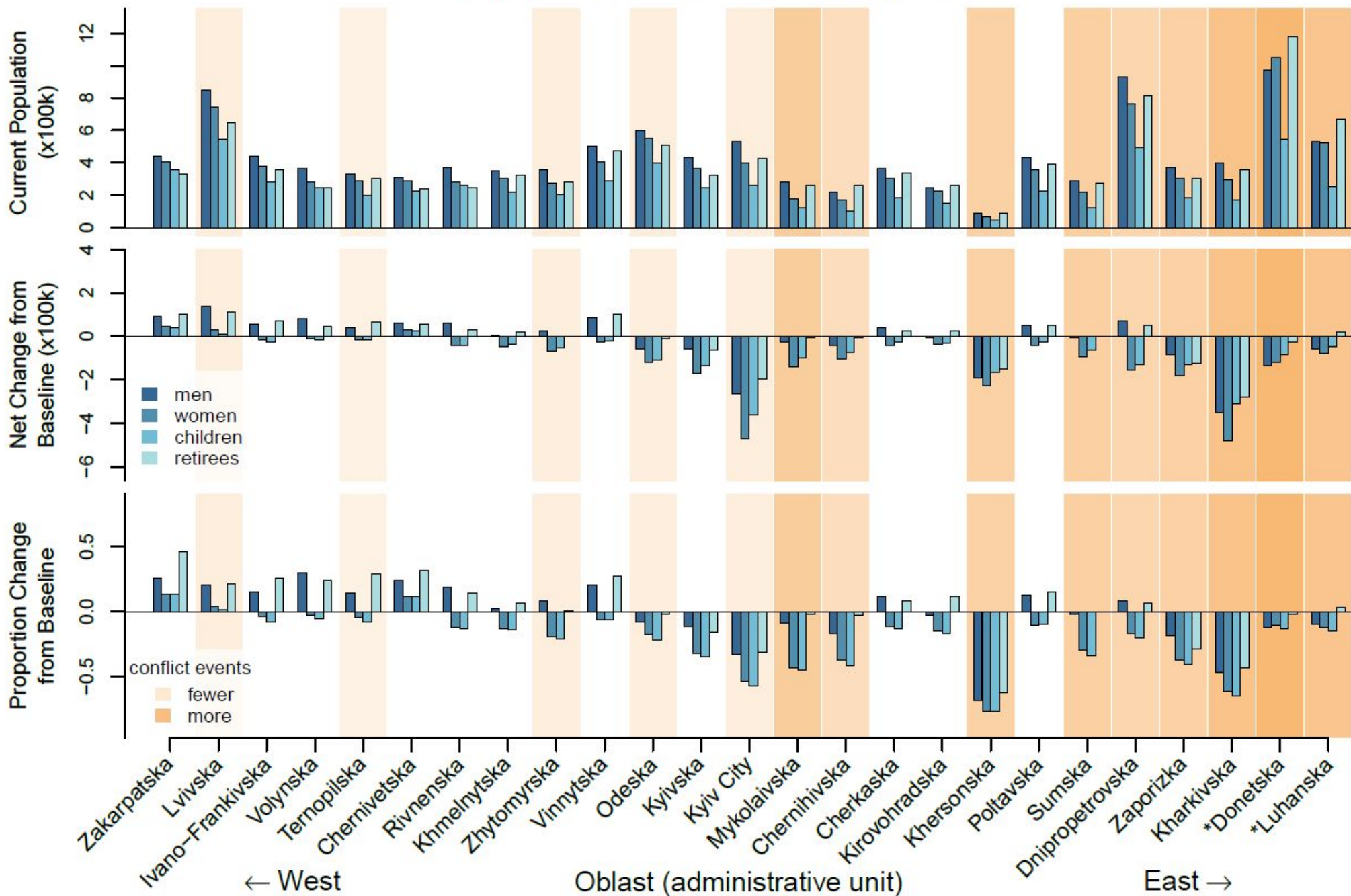
<https://displacement.iom.int/ukraine>



# Oblast populations and net changes (March 14, 2022)



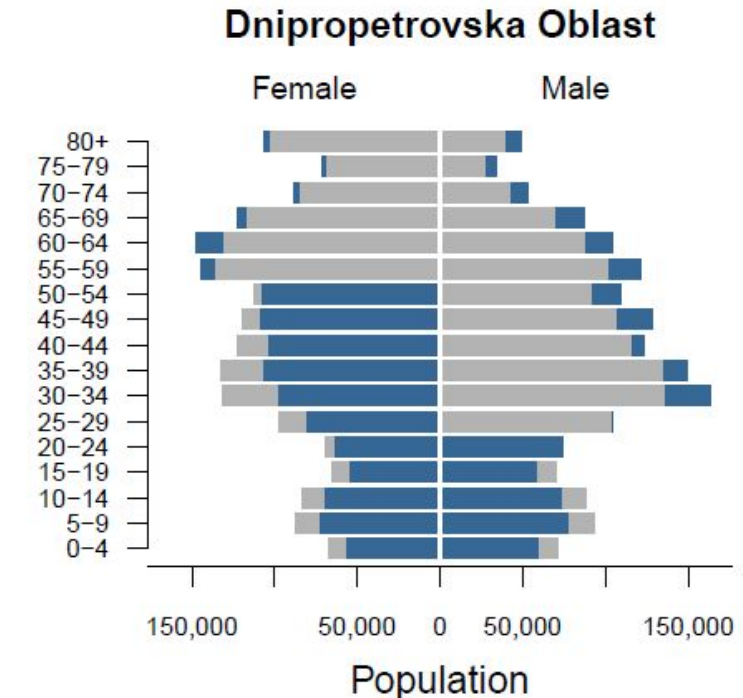
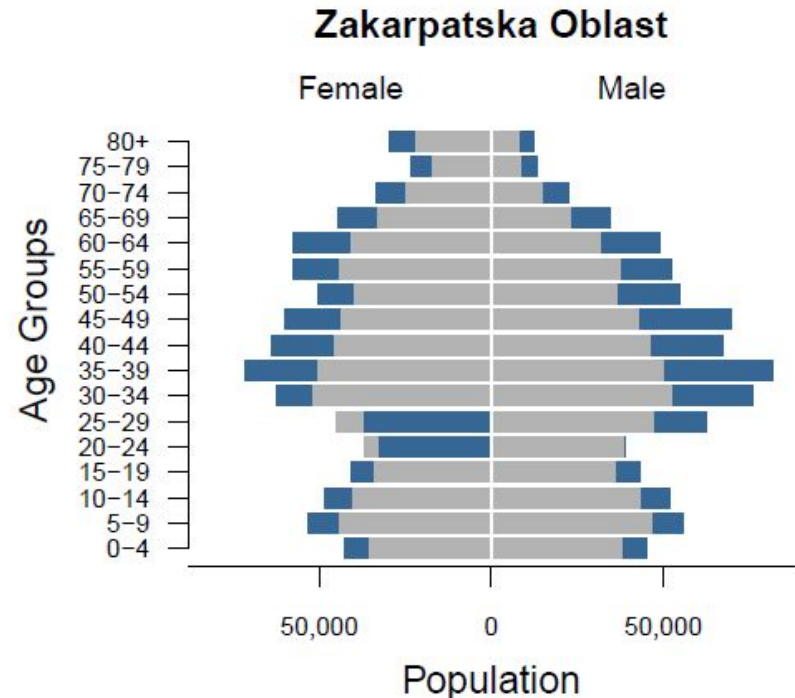
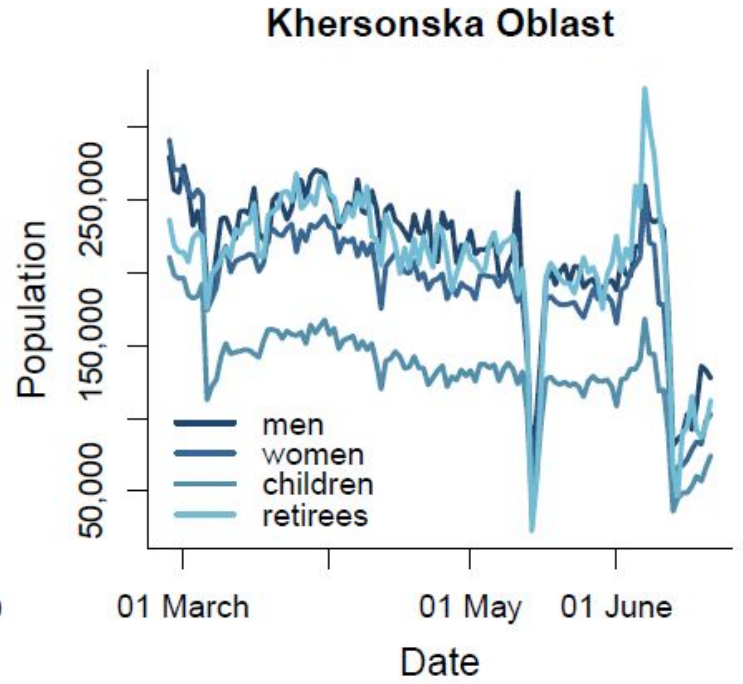
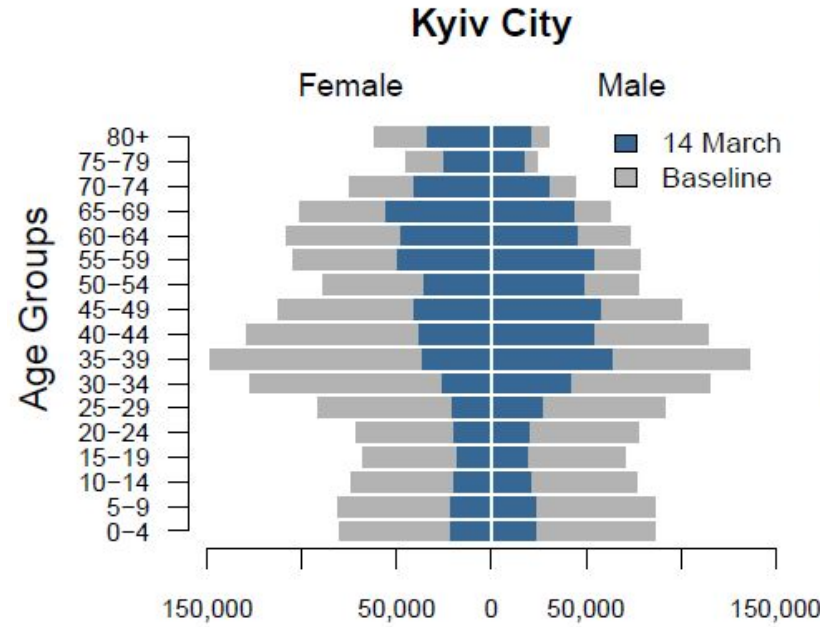
# Oblast populations and net changes (June 15, 2022)





# Demographics of internal displacement

1. *Top-left:* Large scale evacuations
2. *Bottom-left:* Refugee staging locations
3. *Bottom-right:* Internal safe-haven
4. *Top-right:* Irregular population dynamics



# Conclusions

**Facebook marketing API (and others) are opening up new possibilities:**

- Real-time data
- Census of the Facebook user community

**There are also challenges:**

- Data quality (e.g. not a representative sample of the population)
- Data licensing
- Research ethics

# Thank you!

Questions? Suggestions? Want to get involved?

Contact me: [douglas.leasure@sociology.ox.ac.uk](mailto:douglas.leasure@sociology.ox.ac.uk)

