evidation

DIGITAL PHENOTYPING AND POST APPROVAL MONITORING OF DRUGS

Alessio Signorini
asignorini@evidation.com

my expertise is

ARTIFICIAL INTELLIGENCE

my expertise is

ARTIFICIAL INTELLIGENCE

+

co-founder & CTO

EVIDATION HEALTH

@a_signorini

alessio@evidation.com

just a regular guy

Ask
TM
.com
Search

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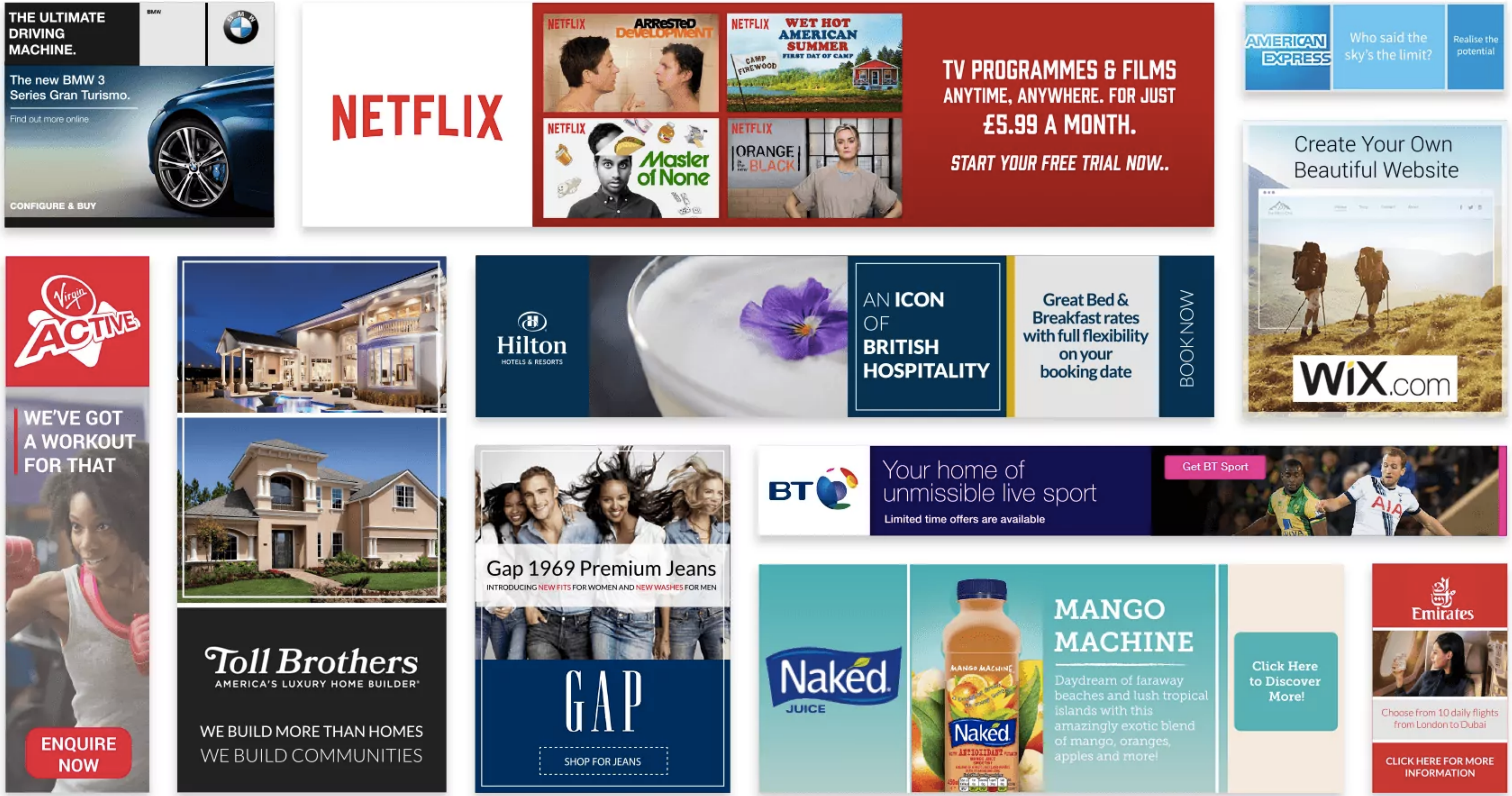
THE ULTIMATE DRIVING MACHINE.
The new BMW 3 Series Gran Turismo.
Find out more online
CONFIGURE & BUY
NETFLIX
ARRESTED DEVELOPMENT
WET HOT AMERICAN SUMMER
Master of None
ORANGE is the new BLACK
TV PROGRAMMES & FILMS ANYTIME, ANYWHERE. FOR JUST £5.99 A MONTH.
START YOUR FREE TRIAL NOW..
AMERICAN EXPRESS
Who said the sky's the limit?
Realise the potential
Create Your Own Beautiful Website
WiX.com
Virgin ACTIVE
WE'VE GOT A WORKOUT FOR THAT
ENQUIRE NOW
Toll Brothers
AMERICA'S LUXURY HOME BUILDER
WE BUILD MORE THAN HOMES
WE BUILD COMMUNITIES
Hilton
HOTELS & RESORTS
AN ICON OF BRITISH HOSPITALITY
Great Bed & Breakfast rates with full flexibility on your booking date
BOOK NOW
Gap 1969 Premium Jeans
INTRODUCING NEW FITS FOR WOMEN AND NEW WASHES FOR MEN
GAP
SHOP FOR JEANS
BT
Your home of unmissible live sport
Limited time offers are available
Get BT Sport
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Daydream of faraway beaches and lush tropical islands with this amazingly exotic blend of mango, oranges, apples and more!
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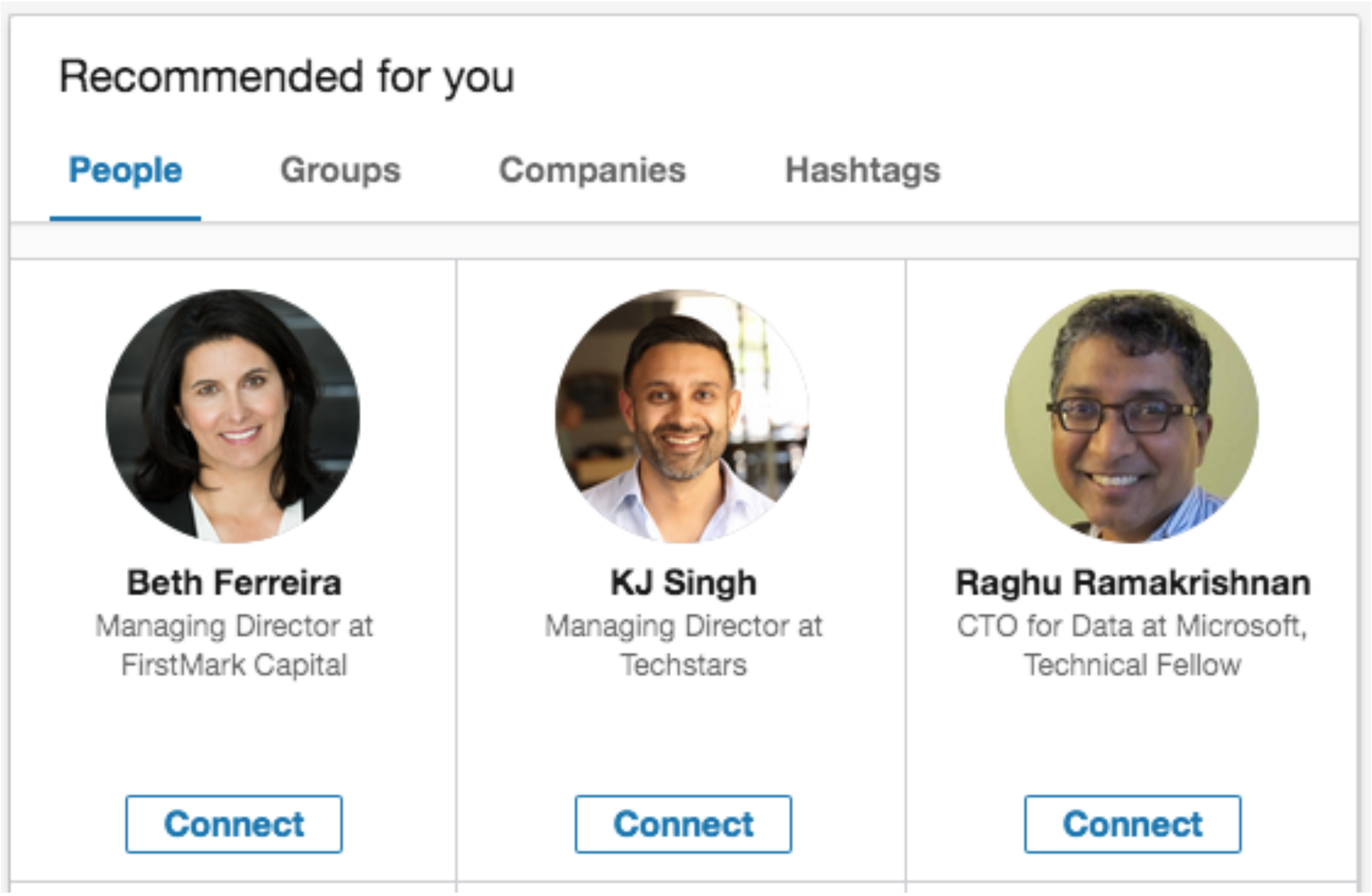
nobody likes Ads

if Ads were perfect, we would call them

RECOMMENDATIONS


Recommended for you

People
Groups
Companies
Hashtags

Beth Ferreira
Managing Director at FirstMark Capital

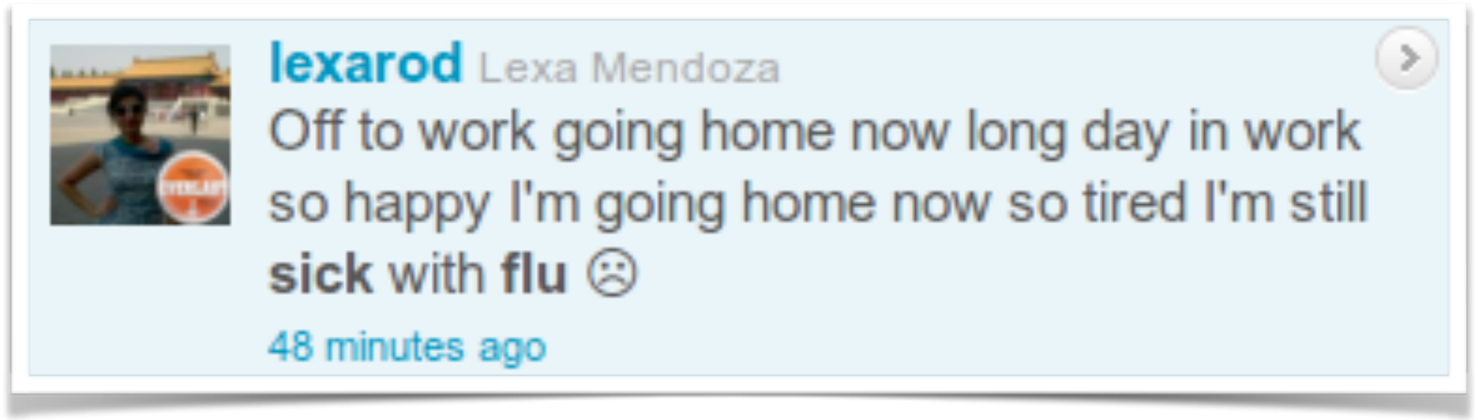
KJ Singh
Managing Director at Techstars

Raghu Ramakrishnan
CTO for Data at Microsoft, Technical Fellow

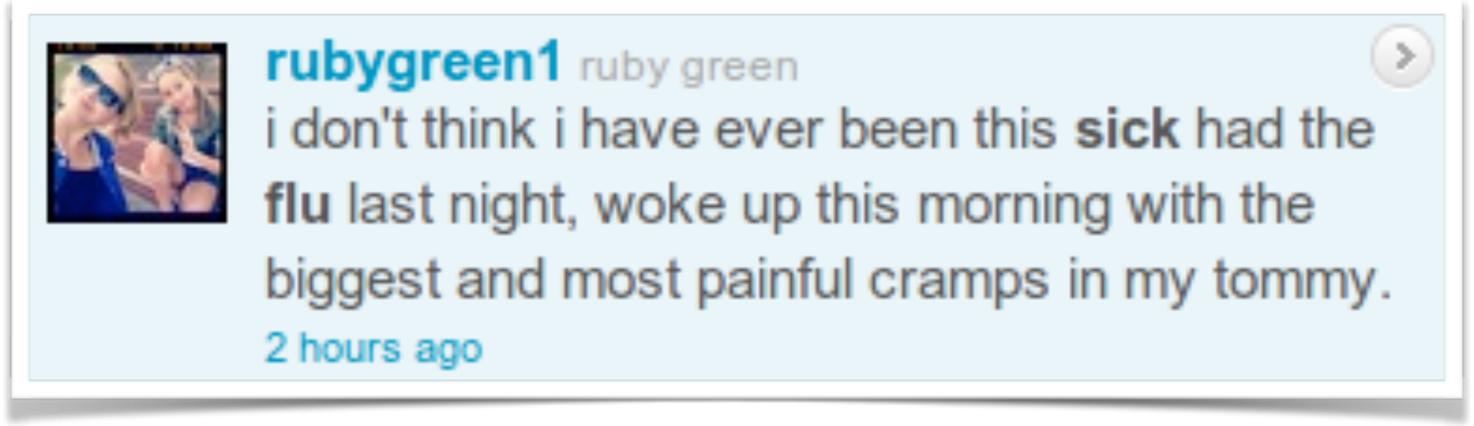
Connect
Connect
Connect

Ads and Login/Share Buttons allow
to create a detailed user profile

we produce thousands of data points every day
wherever we know it or not

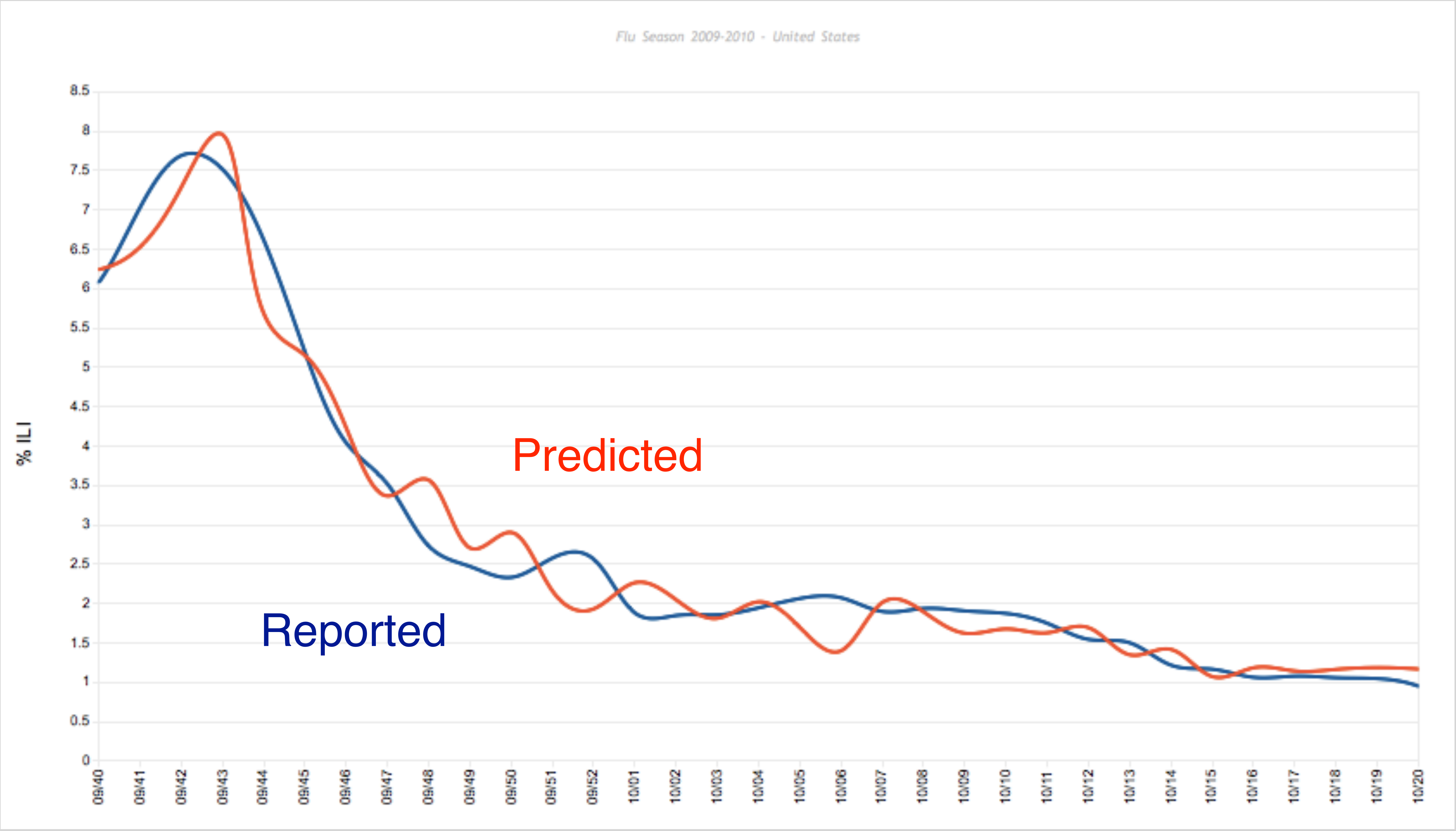


lexarod Lexa Mendoza
Off to work going home now long day in work so happy I'm going home now so tired I'm still **sick** with **flu** ☹
48 minutes ago



rubygreen1 ruby green
i don't think i have ever been this **sick** had the **flu** last night, woke up this morning with the biggest and most painful cramps in my tommy.
2 hours ago

Predicting Influenza-Like Illness (ILI) via Social Media



Predicted

Reported

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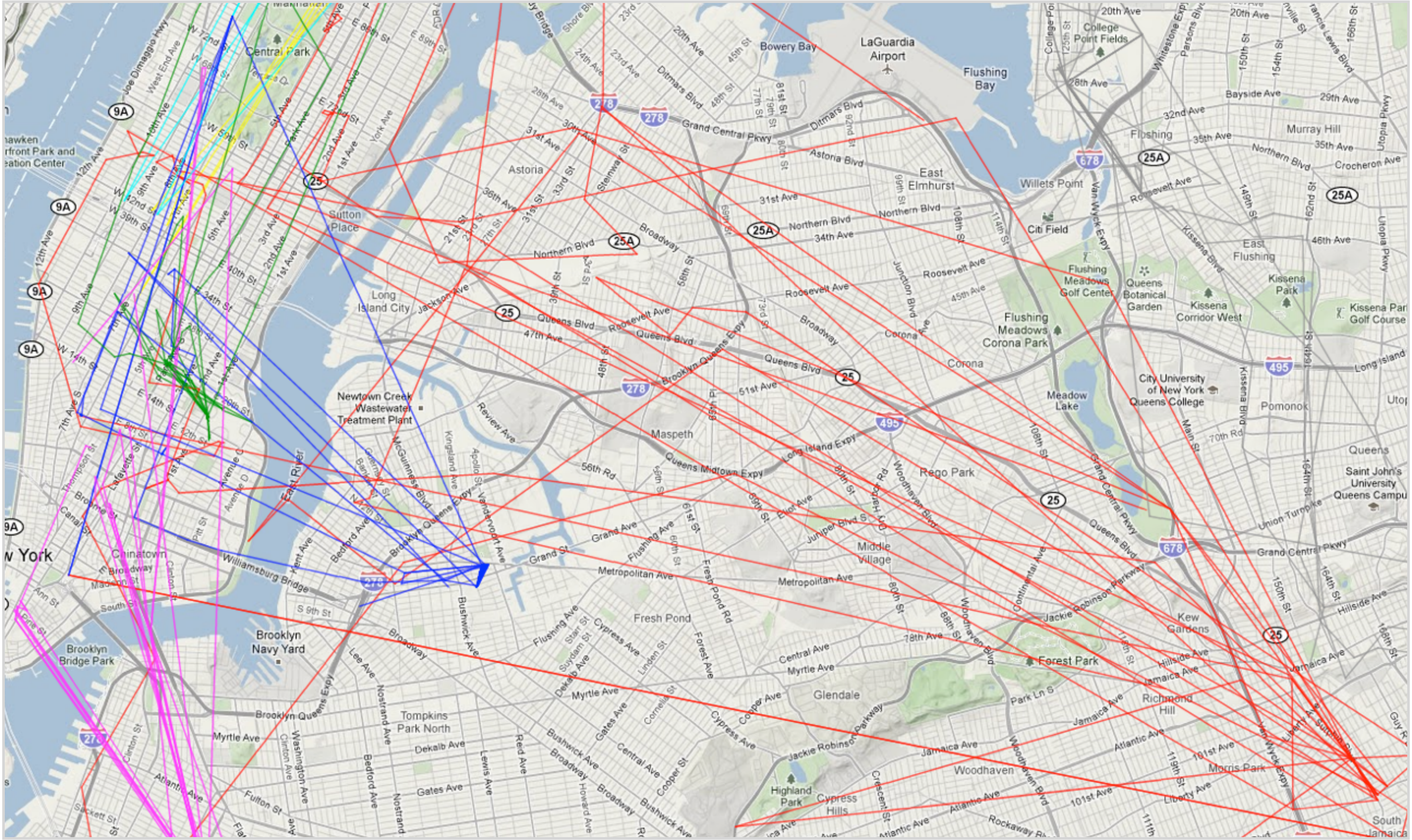
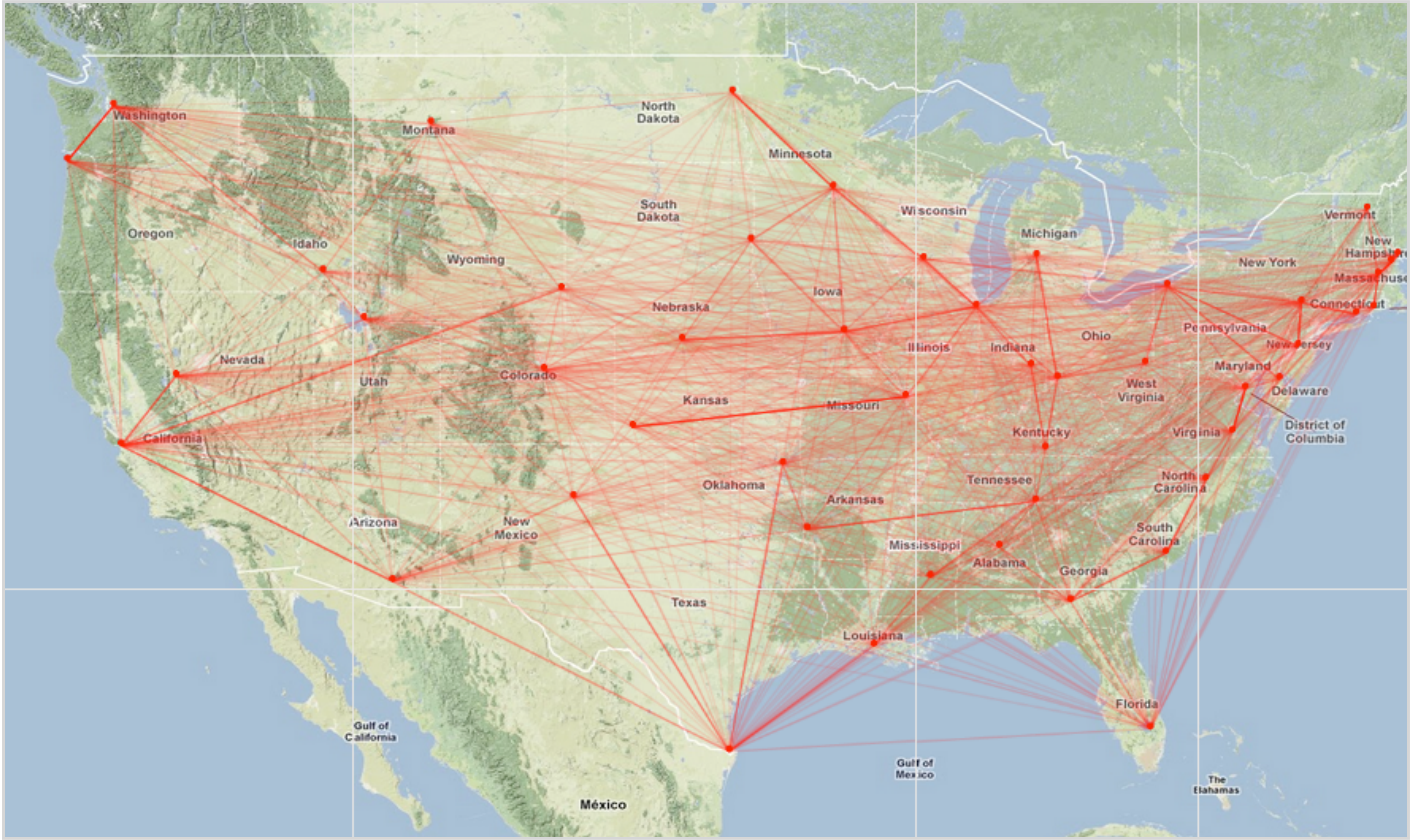
alessio@evidation.com


Central Park
Hoboken Waterfront Park and Recreation Center
Sutton Place
Astoria
LaGuardia Airport
Bowery Bay
Flushing Bay
East Elmhurst
Willets Point
Citi Field
Flushing
Murray Hill
East Flushing
Kissena Park
Flushing Meadows Golf Center
Queens Botanical Garden
Kissena Corridor West
Flushing Meadows Corona Park
Corona
Long Island City
Newtown Creek Wastewater Treatment Plant
Maspeth
Meadow Lake
City University of New York Queens College
Pomonok
Saint John's University Queens Campus
Rego Park
Middle Village
Chinatown
New York
Brooklyn Navy Yard
Brooklyn Bridge Park
Fresh Pond
Glendale
Forest Park
Kew Gardens
Richmond Hill
Woodhaven
Highland Park
Cypress Hills
Tompkins Park North
South Jamaica

Movements of people in NYC


Washington
Montana
North Dakota
Minnesota
Oregon
Idaho
South Dakota
Wisconsin
Michigan
Wyoming
Vermont
New Hampshire
New York
Massachusetts
Iowa
Nebraska
Connecticut
Pennsylvania
Nevada
Illinois
Indiana
Ohio
New Jersey
Utah
Colorado
Maryland
Kansas
Missouri
West Virginia
Delaware
District of Columbia
California
Kentucky
Virginia
Oklahoma
Tennessee
North Carolina
Arkansas
Arizona
New Mexico
South Carolina
Mississippi
Alabama
Georgia
Texas
Louisiana
Florida
Gulf of California
Gulf of Mexico
The Bahamas
México

Movements of people across the US

@a_signorini

alessio@evidation.com

Aggregated

Traded

Hacked

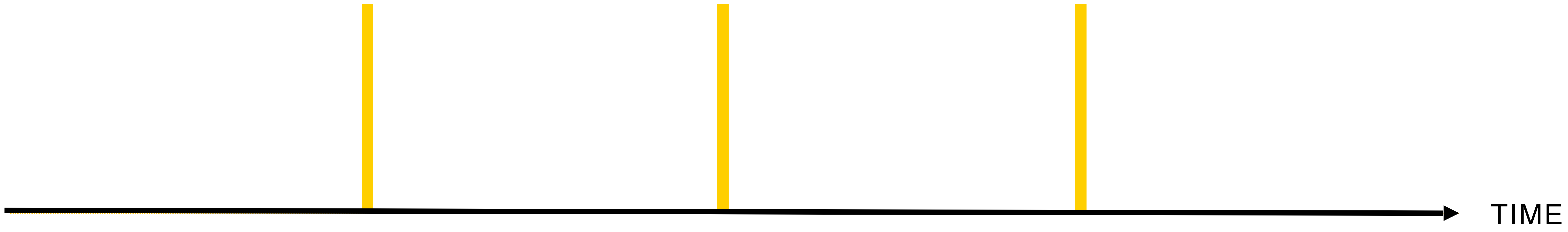
FINE GOLD
999.9
NET WT 1000 g
NET WT 1000 g

Sold

@a_signorini

alessio@evidation.com

Doctors see our data only when we are sick



DATA POINTS

Visible

episodic

What about the missing 99%?

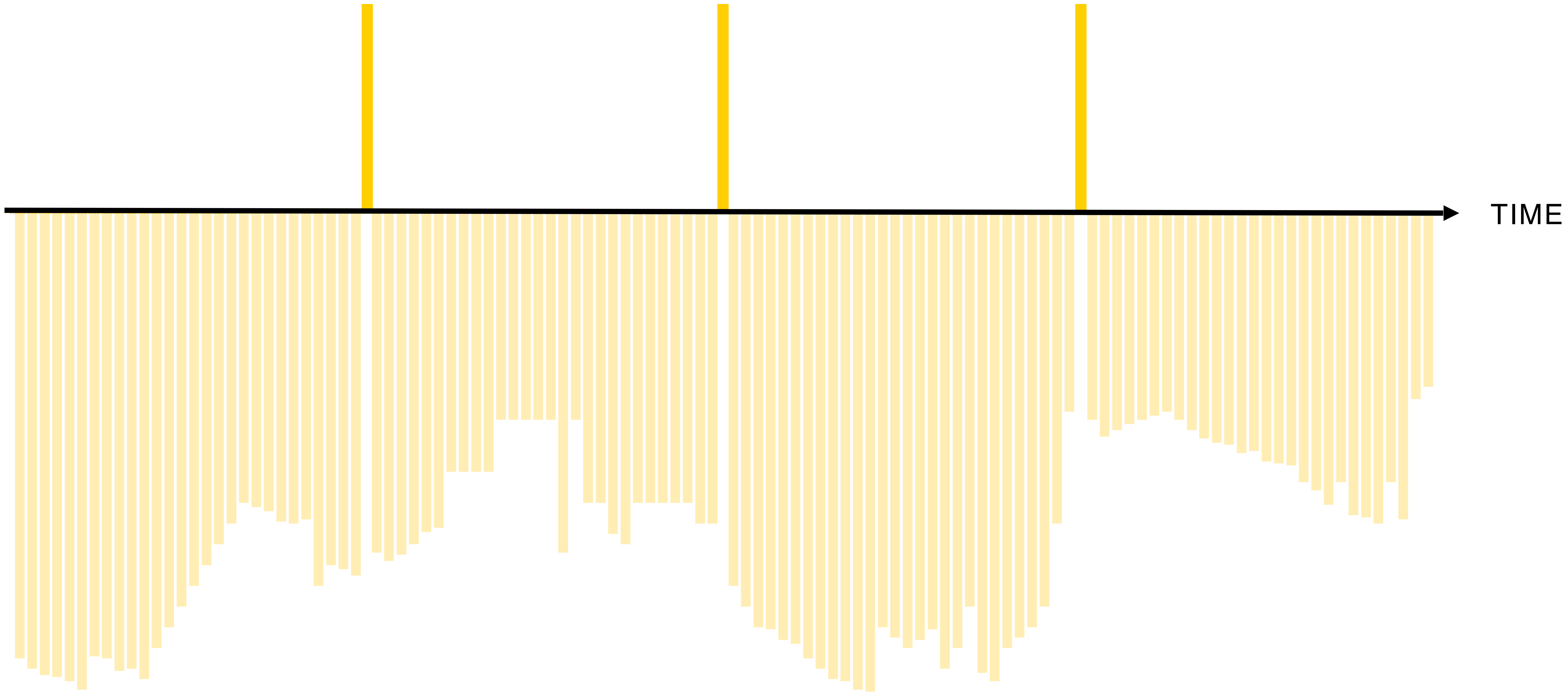
DATA POINTS

Visible

episodic

Invisible

continuous,
passive



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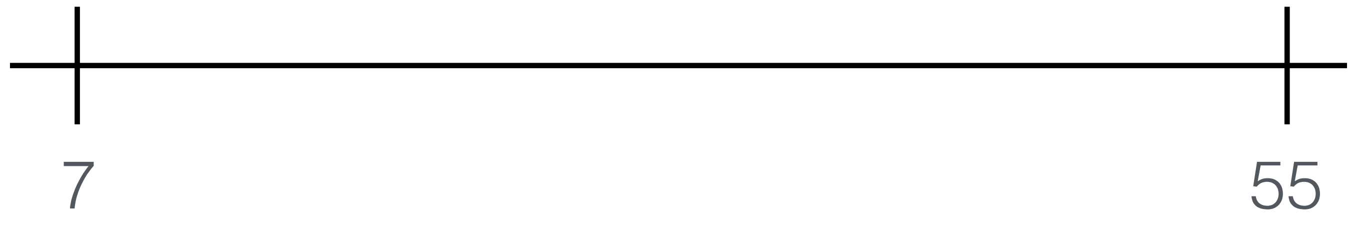
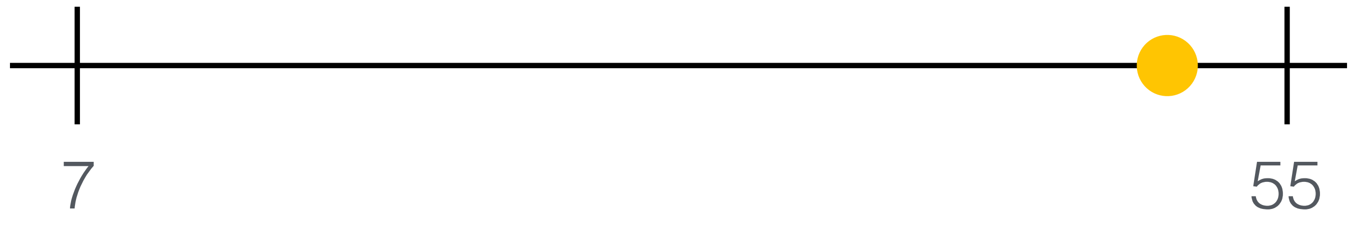
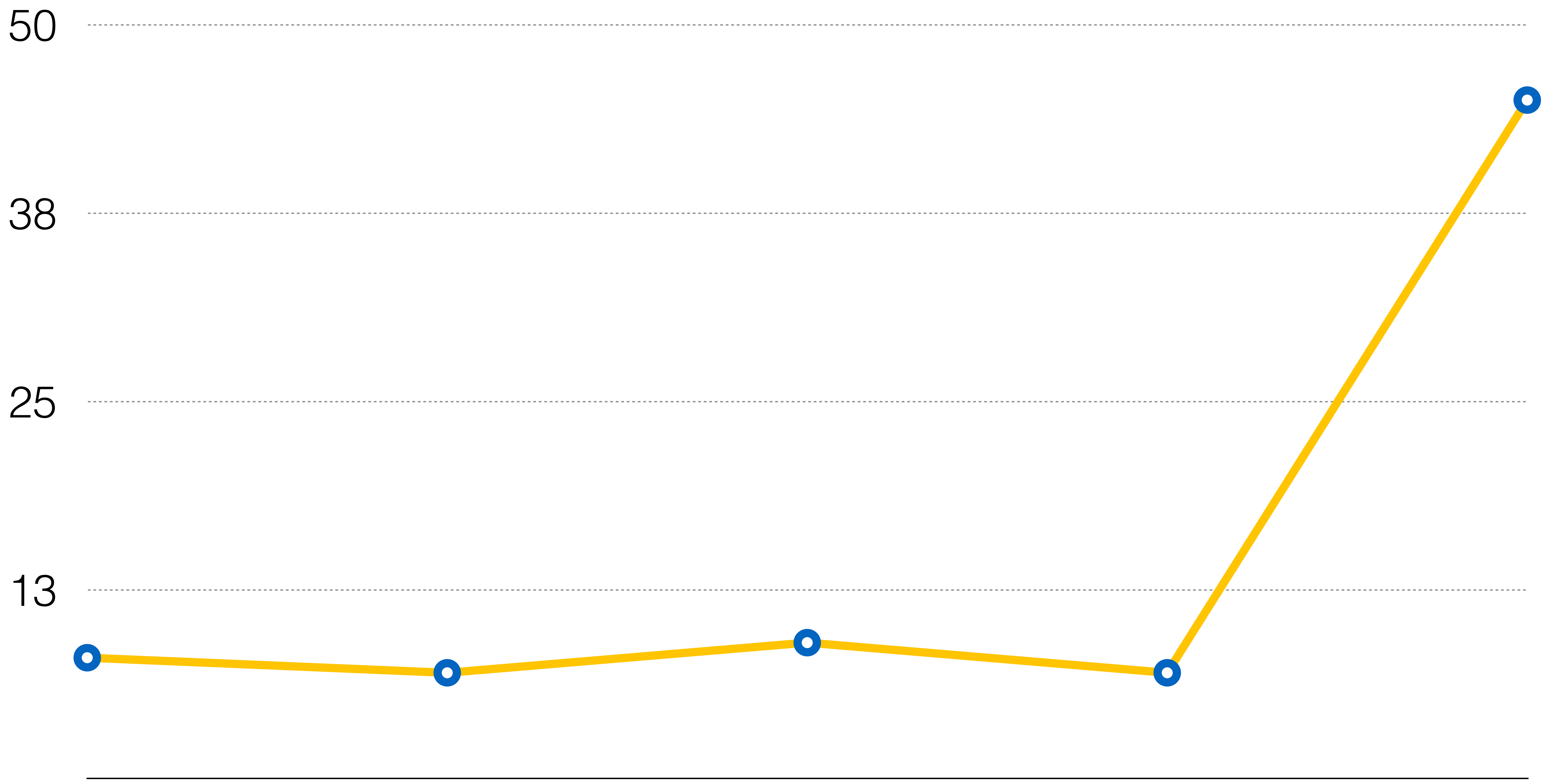
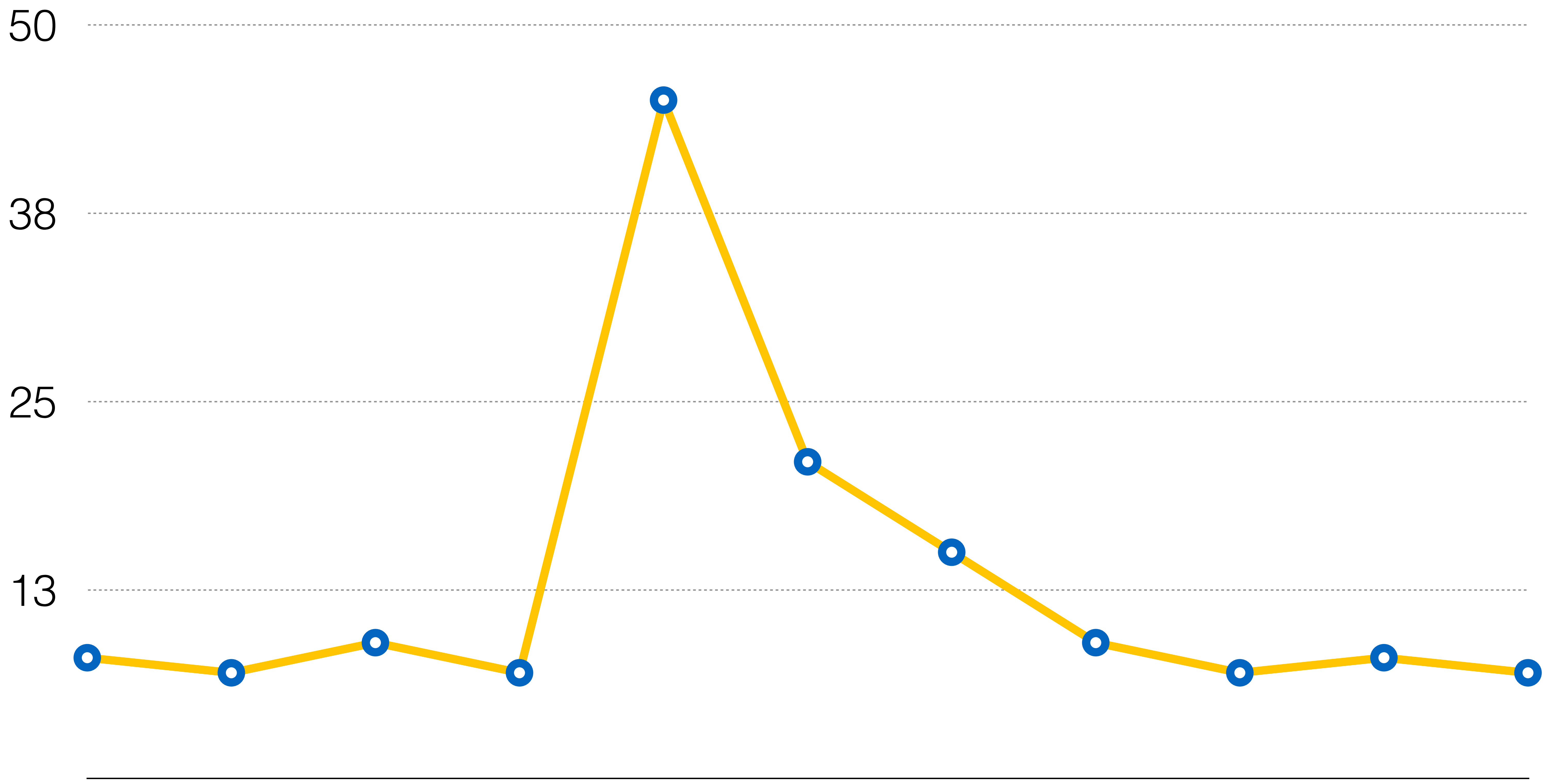

7
55


7
55


50
38
25
13

evidation



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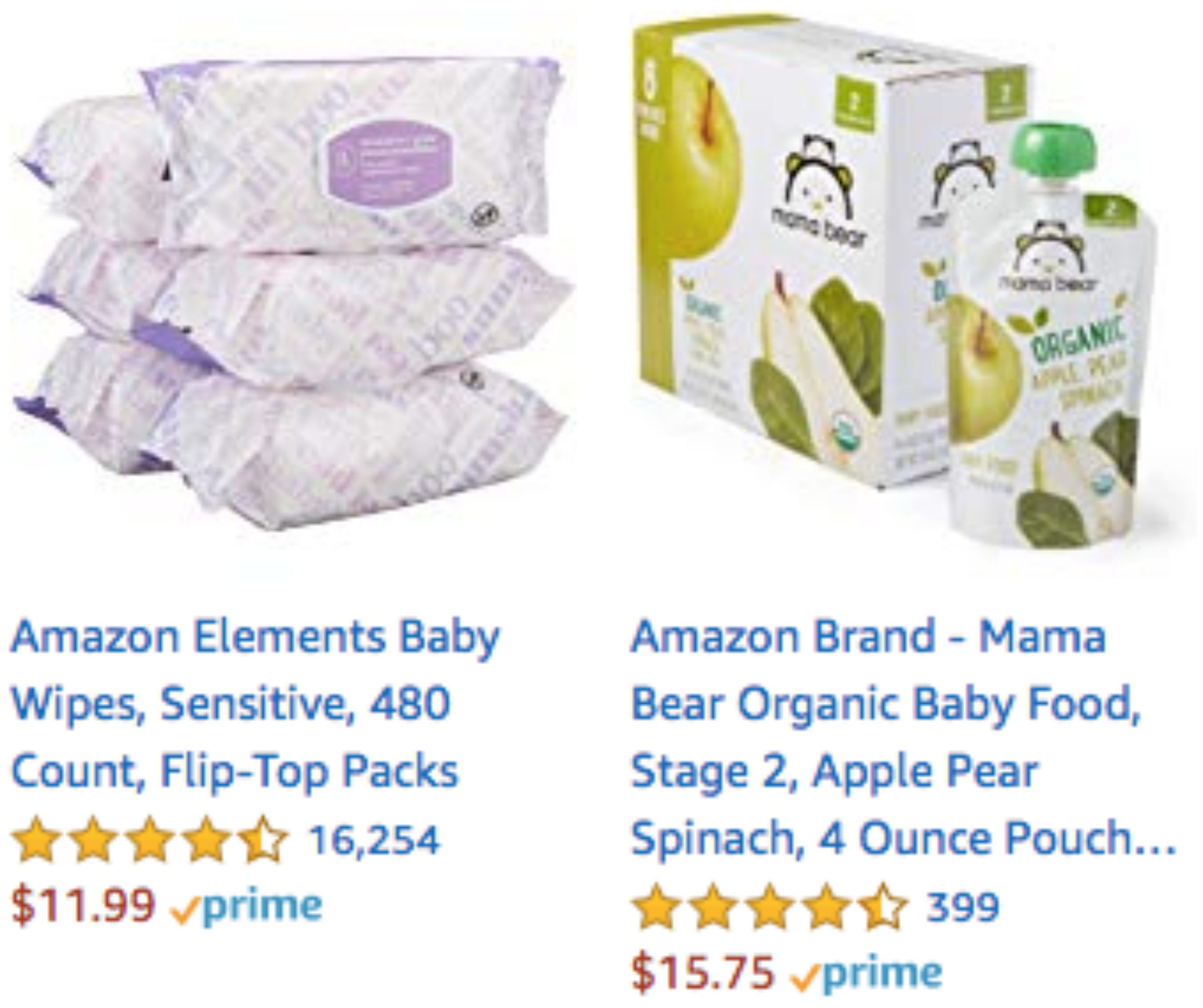
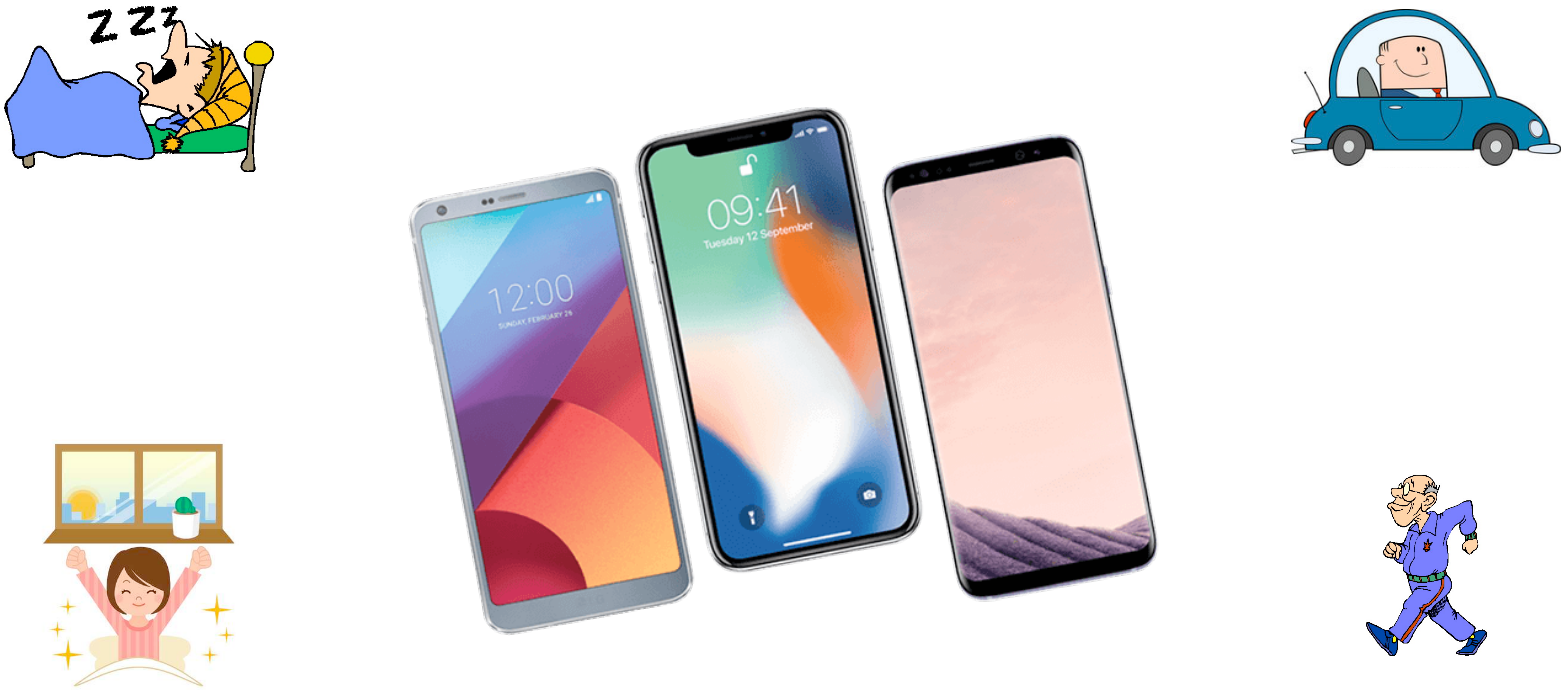
Better Profiling

vs.

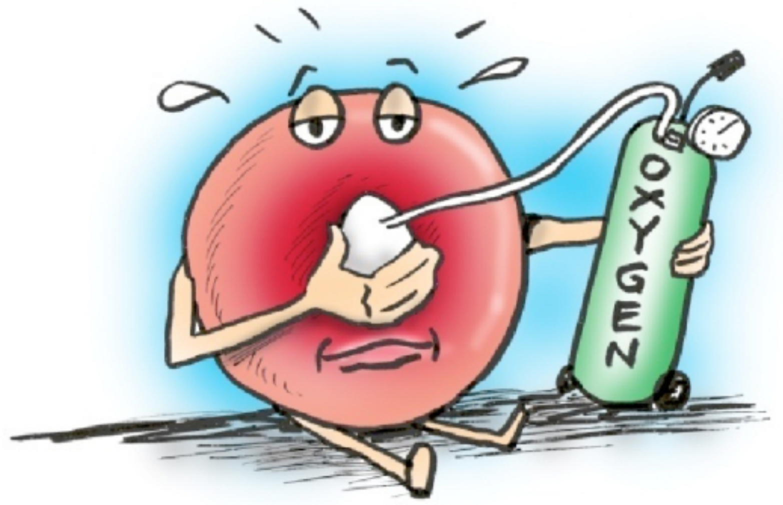


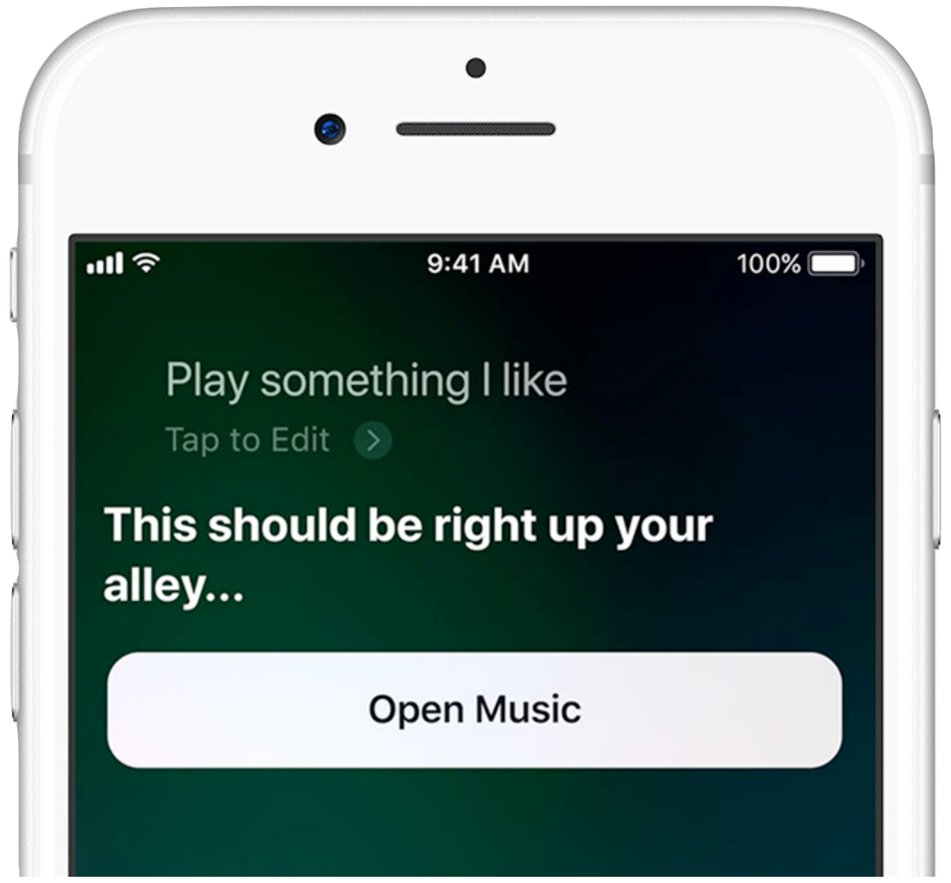
Amazon Elements Baby Wipes, Sensitive, 480 Count, Flip-Top Packs
★★★★☆ 16,254
$11.99 ✓prime

Amazon Brand - Mama Bear Organic Baby Food, Stage 2, Apple Pear Spinach, 4 Ounce Pouch...
★★★★☆ 399
$15.75 ✓prime


Z Z Z
12:00
SUNDAY, FEBRUARY 26
09:41
Tuesday 12 September

moto
MON
5
689
61°
2:33
3236 steps
418 pts
of 500


OXYGEN


9:41 AM
100%

Play something I like

Tap to Edit

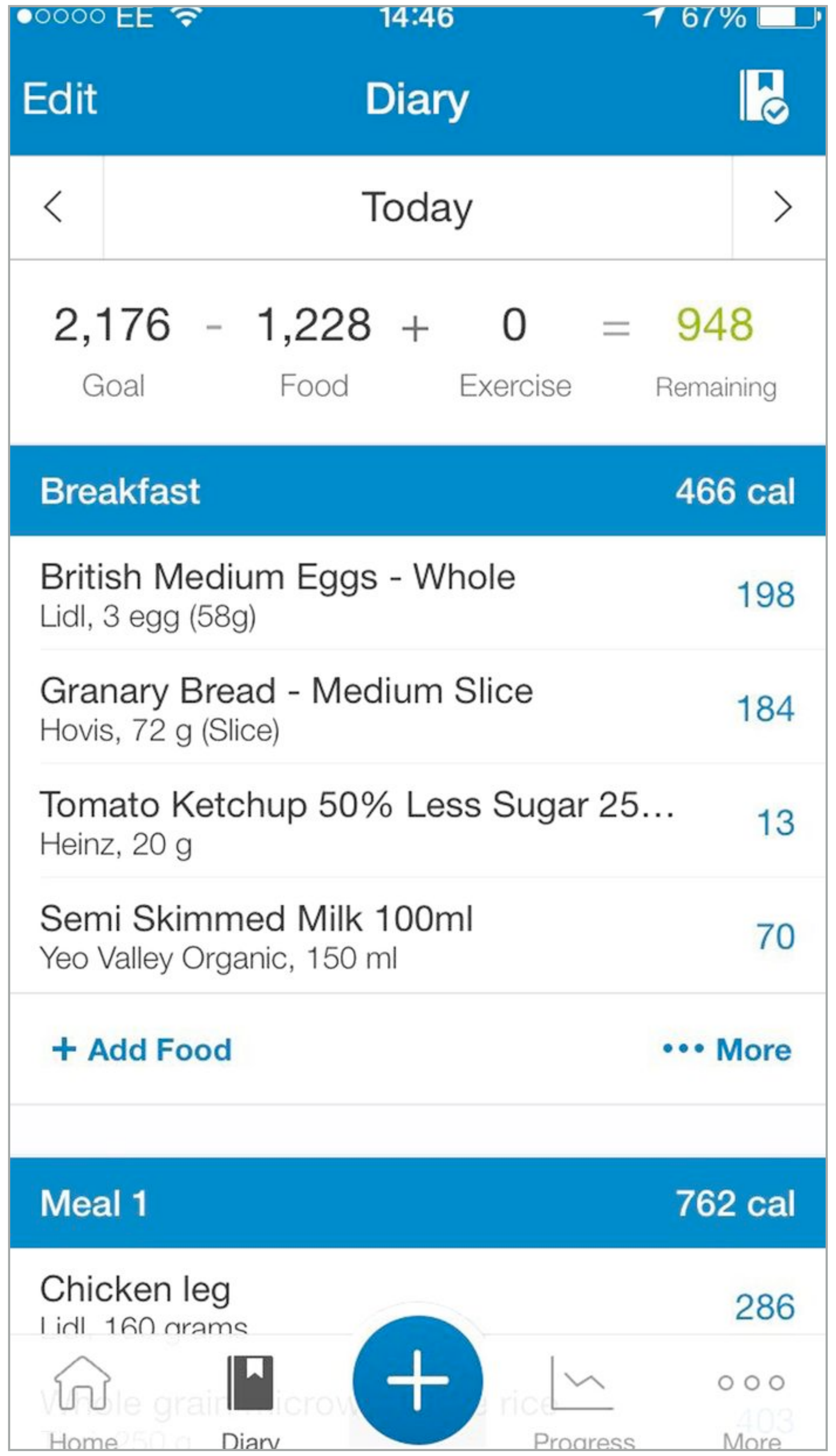
This should be right up your alley...

Open Music

Hey, Siri

Alexa

Ok, Google

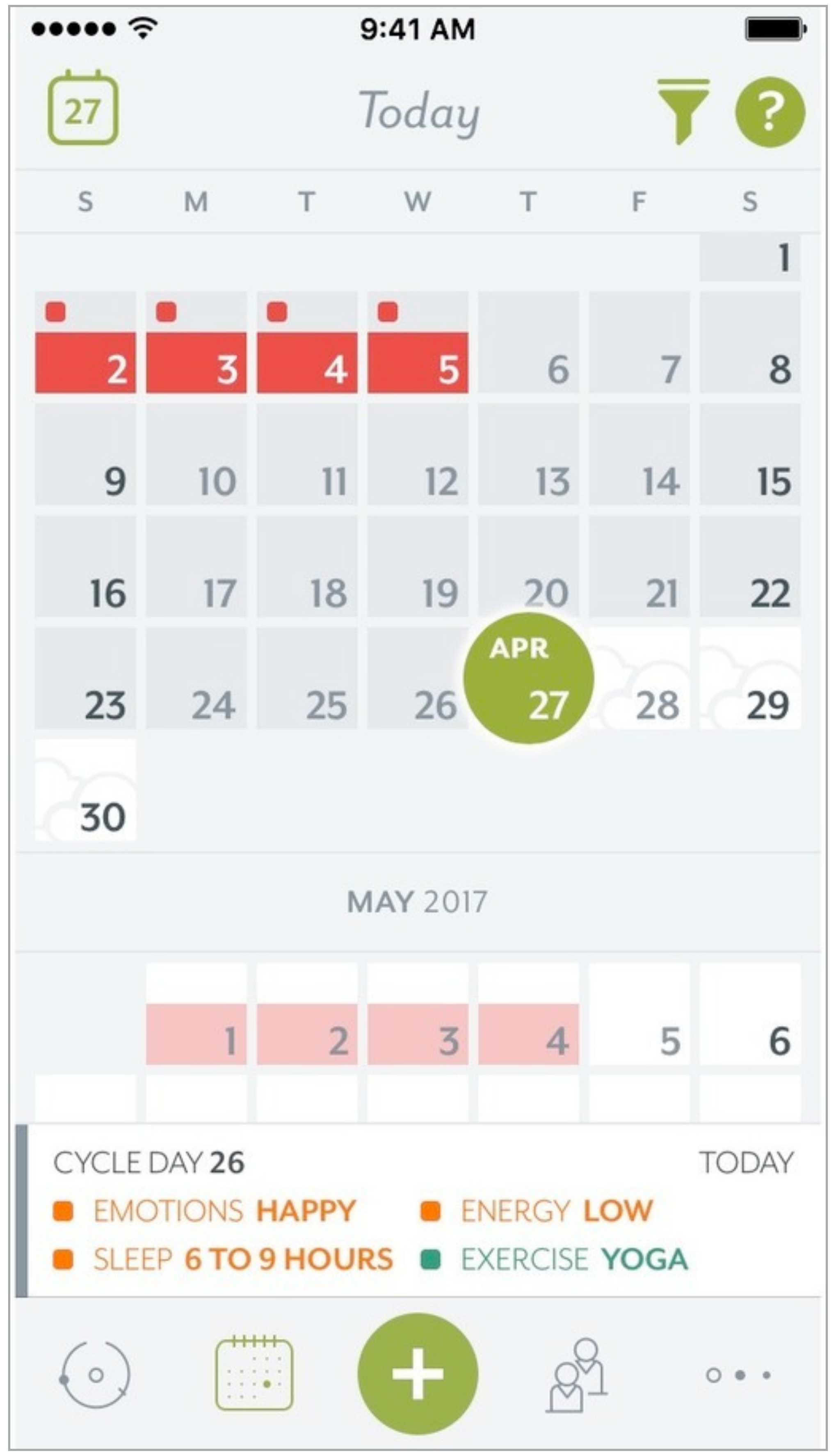

●○○○○ EE
14:46
67%
Edit
Diary
Today
Home
Diary
Progress
More

Goal	Food	Exercise	Remaining
2,176	- 1,228	+ 0	= 948

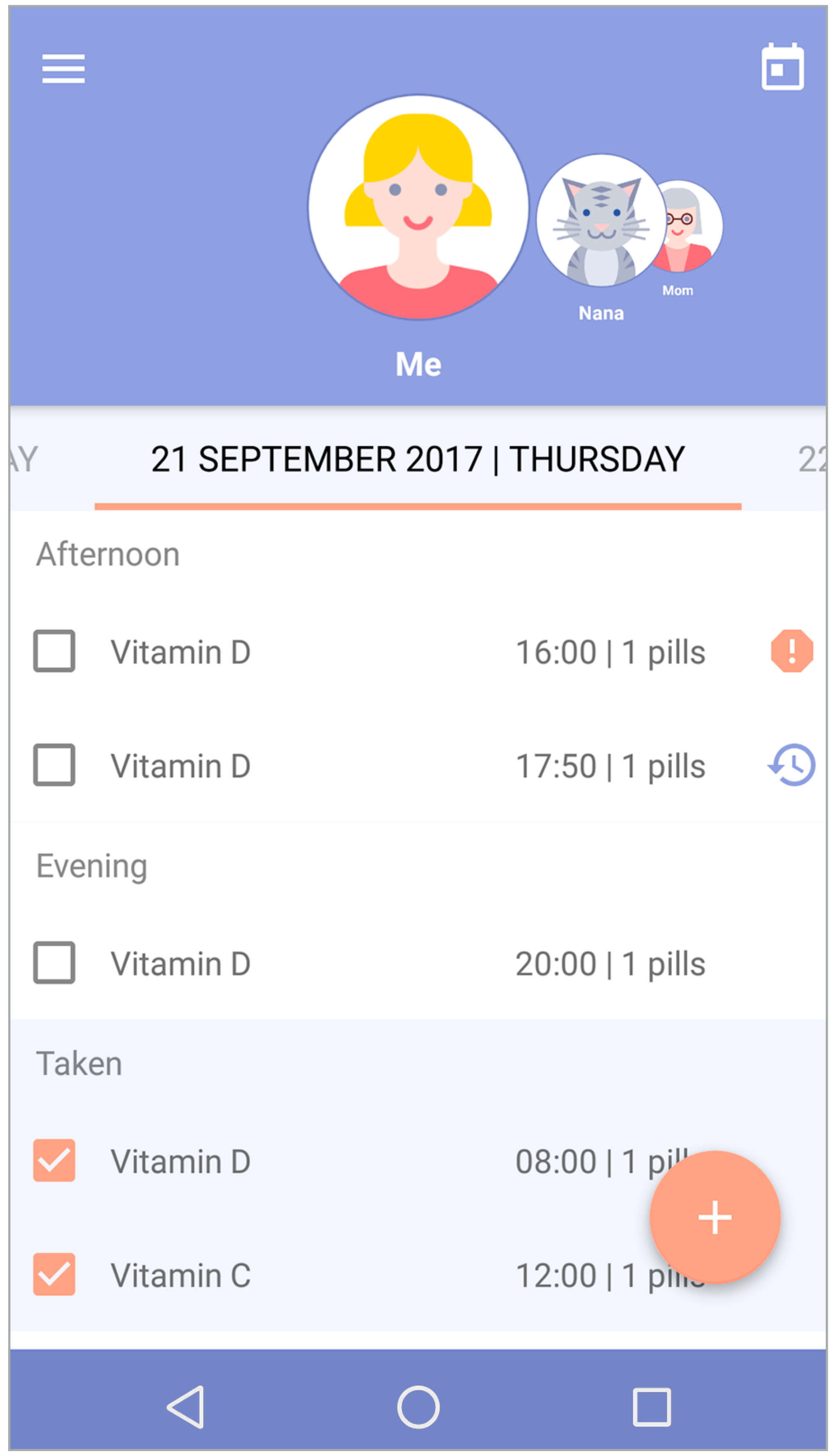
Breakfast	466 cal
British Medium Eggs - Whole Lidl, 3 egg (58g)	198
Granary Bread - Medium Slice Hovis, 72 g (Slice)	184
Tomato Ketchup 50% Less Sugar 25… Heinz, 20 g	13
Semi Skimmed Milk 100ml Yeo Valley Organic, 150 ml	70

+ Add Food ••• More

Meal 1	762 cal
Chicken leg Lidl, 160 grams	286


●●●●●
9:41 AM
27
Today
?
S M T W T F S
1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 APR 27 28 29
30
MAY 2017
1 2 3 4 5 6

CYCLE DAY 26 TODAY
- EMOTIONS HAPPY
- ENERGY LOW
- SLEEP 6 TO 9 HOURS
- EXERCISE YOGA


Me
Nana
Mom
AY
22

21 SEPTEMBER 2017 | THURSDAY

Afternoon

☐ Vitamin D 16:00 | 1 pills

☐ Vitamin D 17:50 | 1 pills

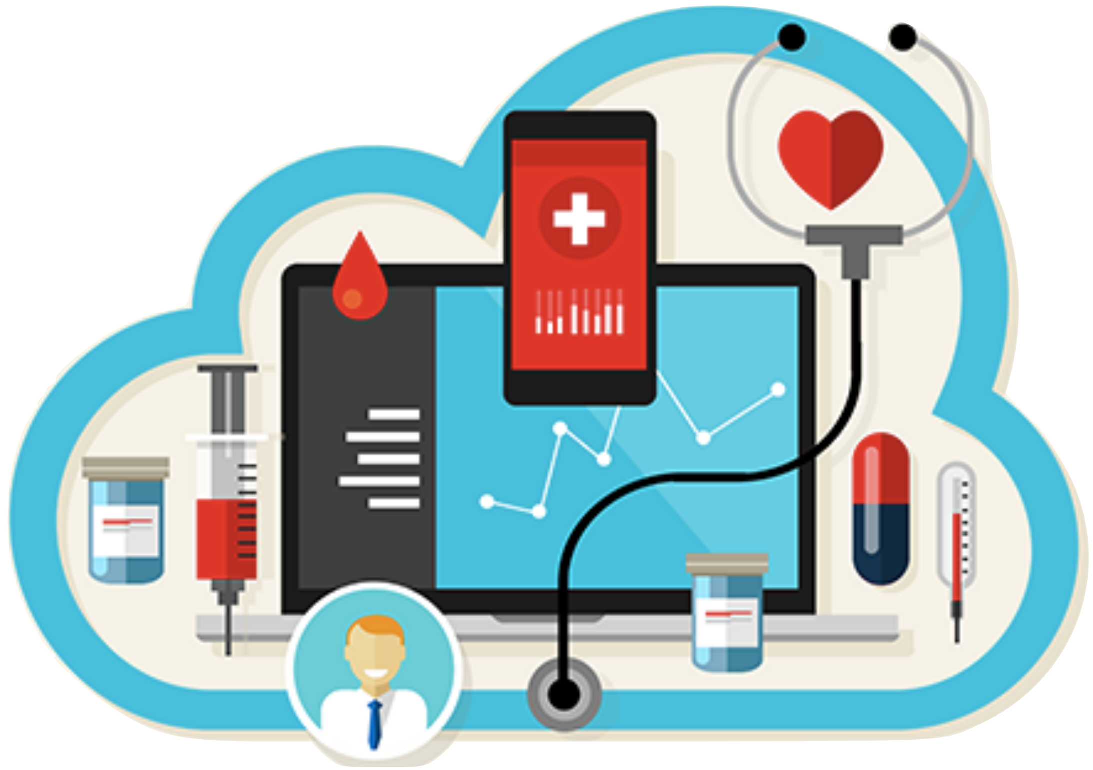
Evening

☐ Vitamin D 20:00 | 1 pills

Taken

☑ Vitamin D 08:00 | 1 pill

☑ Vitamin C 12:00 | 1 pills



let’s bring all this real-world evidence into healthcare

12:45
NOV 27
76

500,000x
year

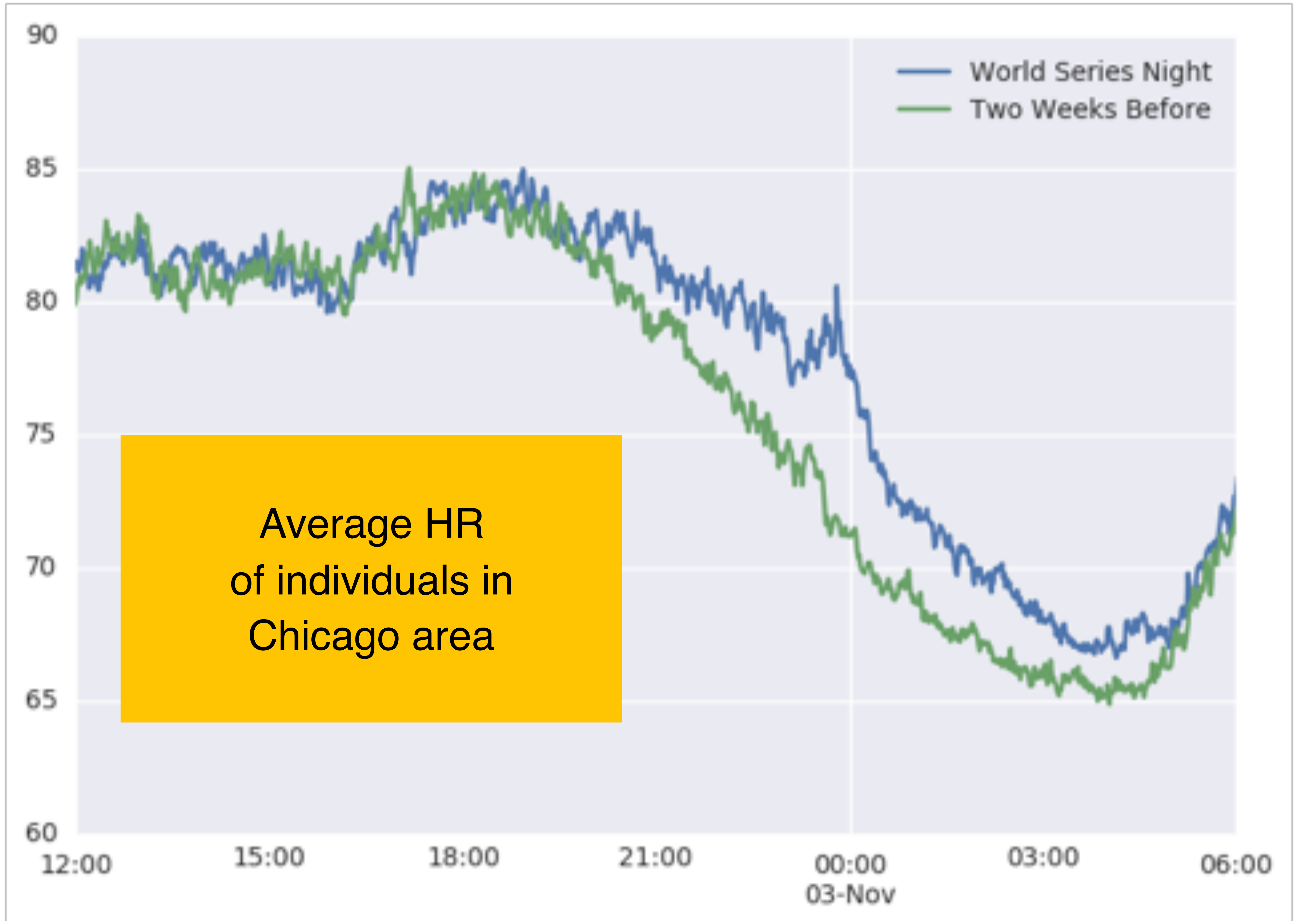
1 time
year

World Series 2016 - Chicago Cubs

vs.

Cleveland, OH
November 2nd, 8pm EST
4h28m

World Series 2016 - Chicago Cubs

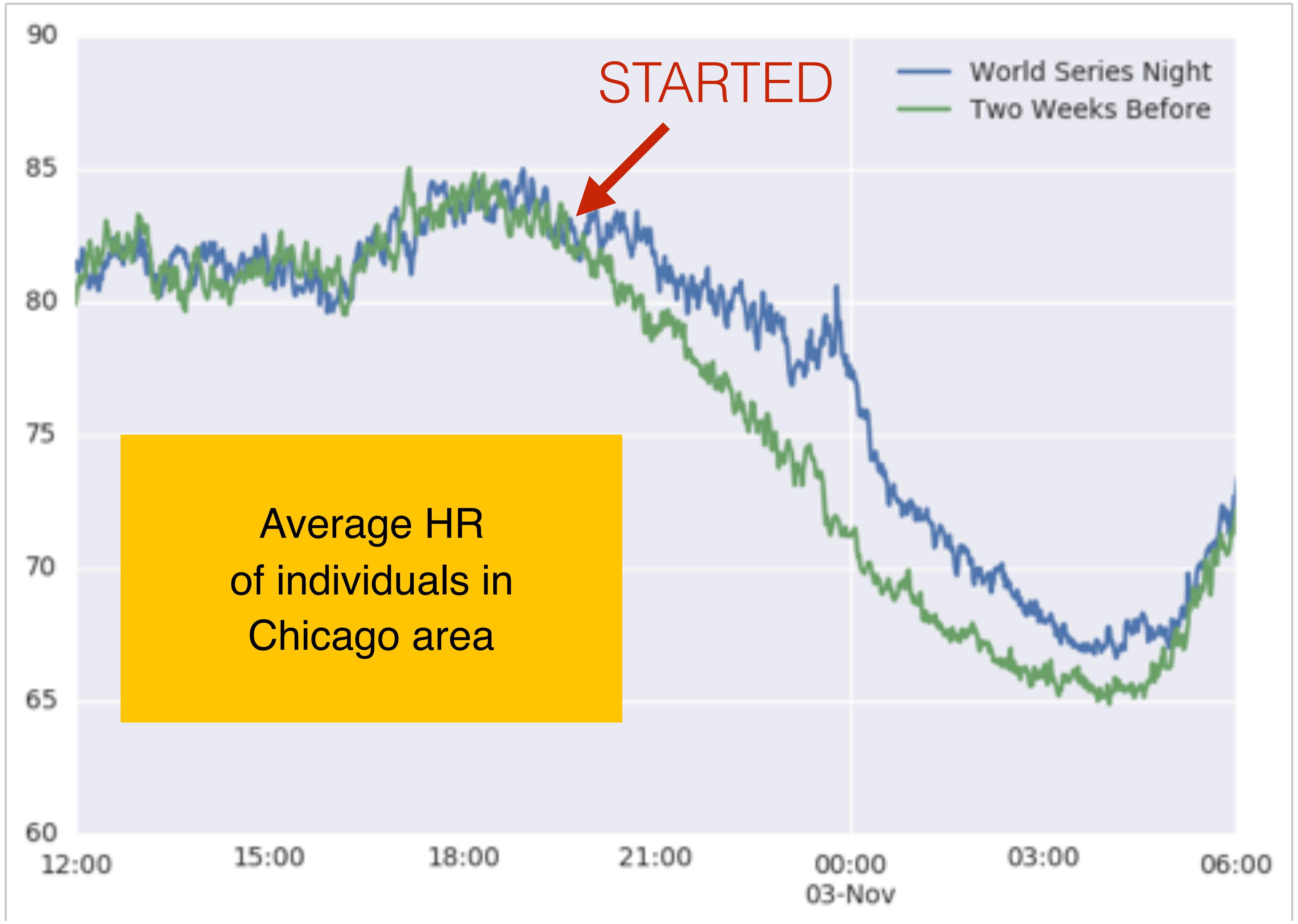


Average HR
of individuals in
Chicago area

@a_signorini

alessio@evidation.com

World Series 2016 - Chicago Cubs



Average HR
of individuals in
Chicago area

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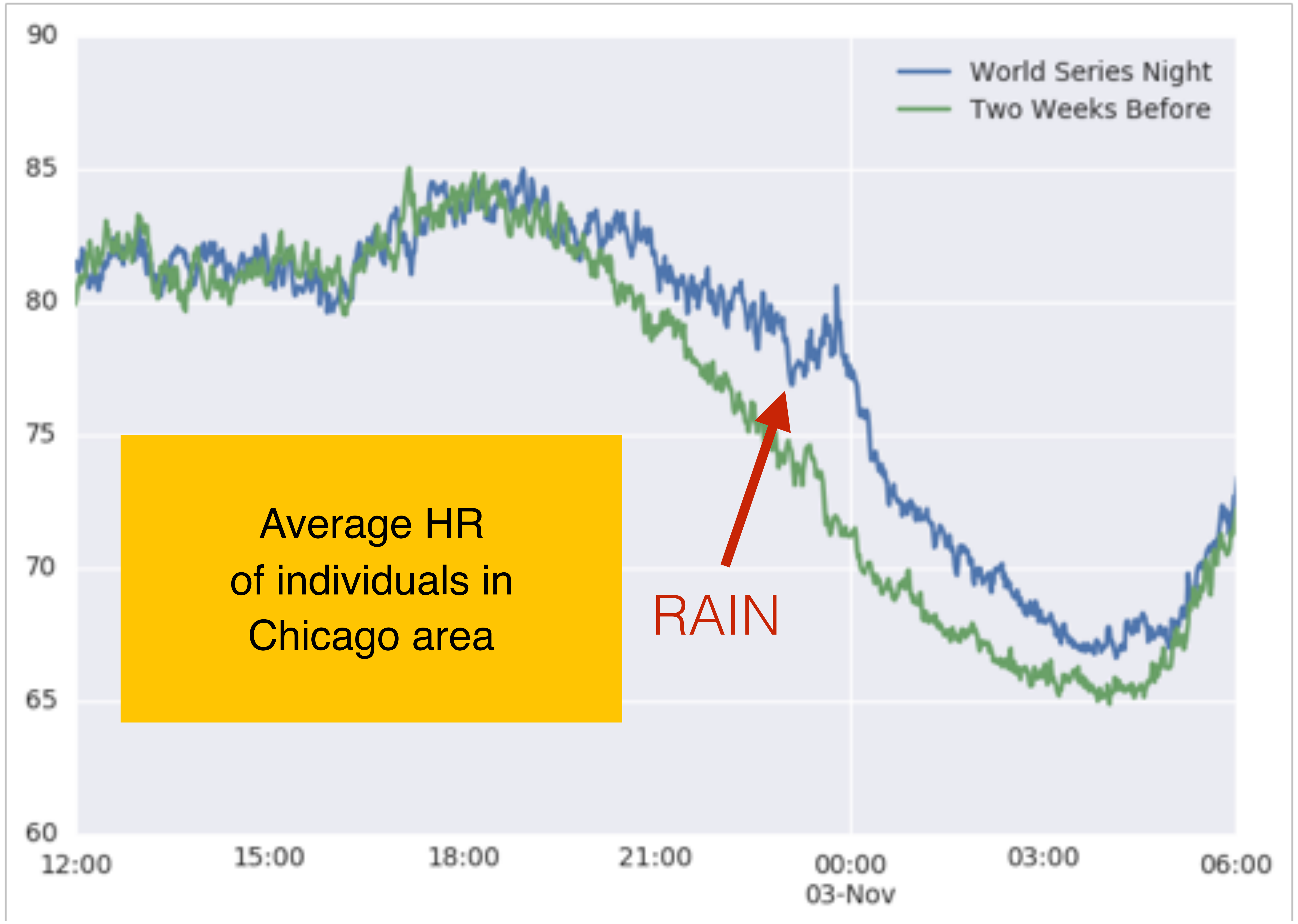
World Series 2016 - Chicago Cubs



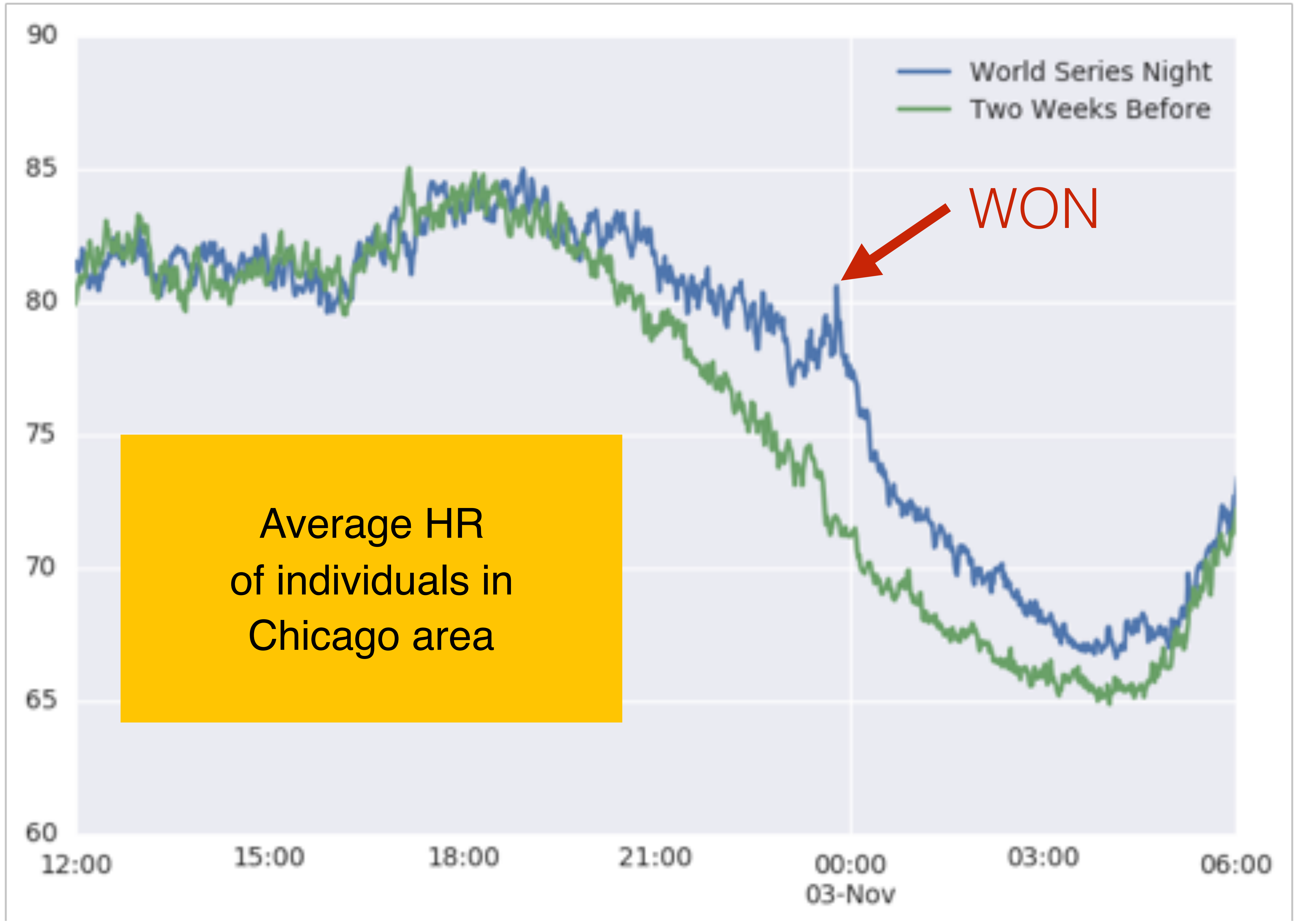
Average HR
of individuals in
Chicago area

RAIN

@a_signorini

alessio@evidation.com

World Series 2016 - Chicago Cubs

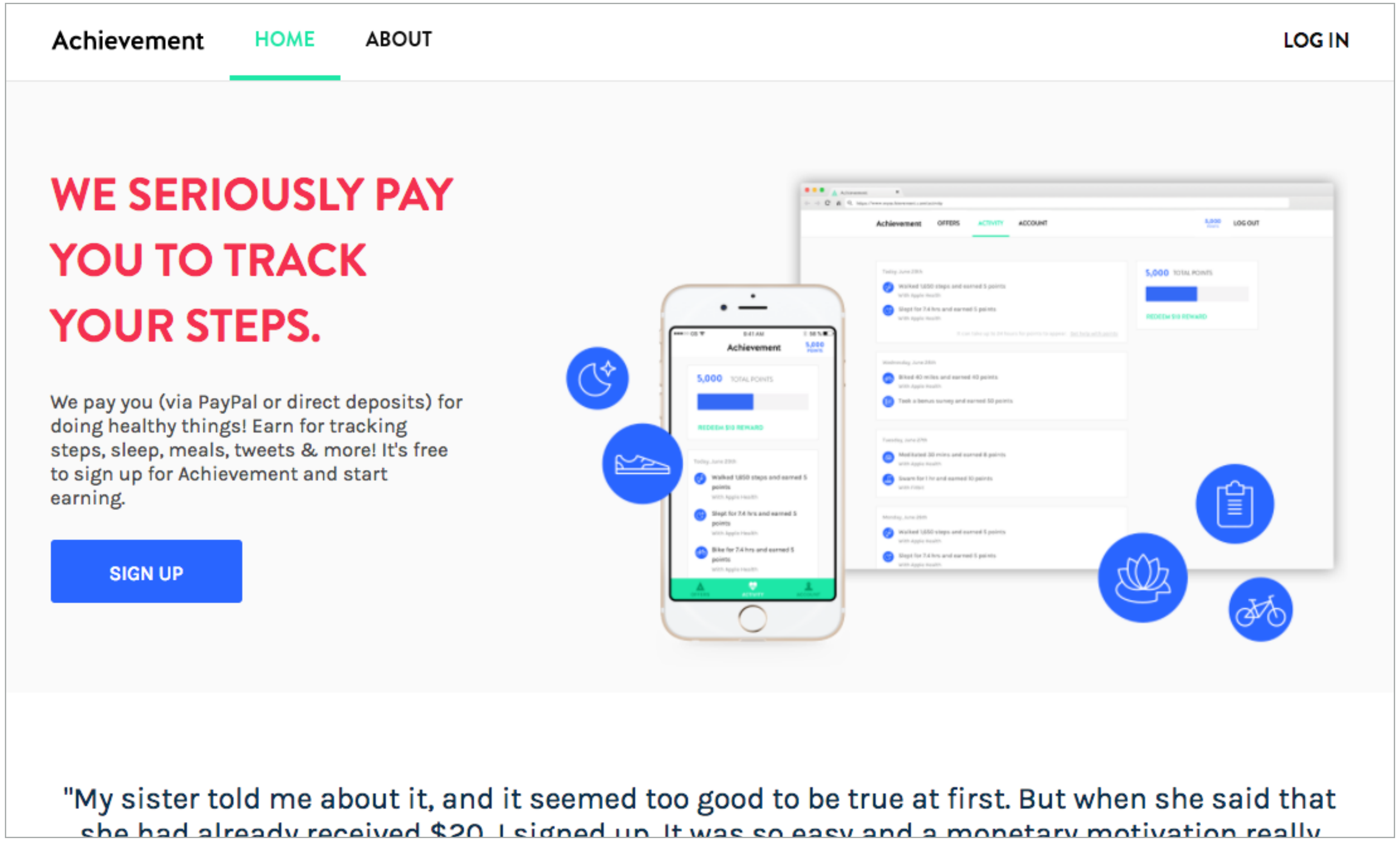


WON

Average HR
of individuals in
Chicago area

@a_signorini

alessio@evidation.com



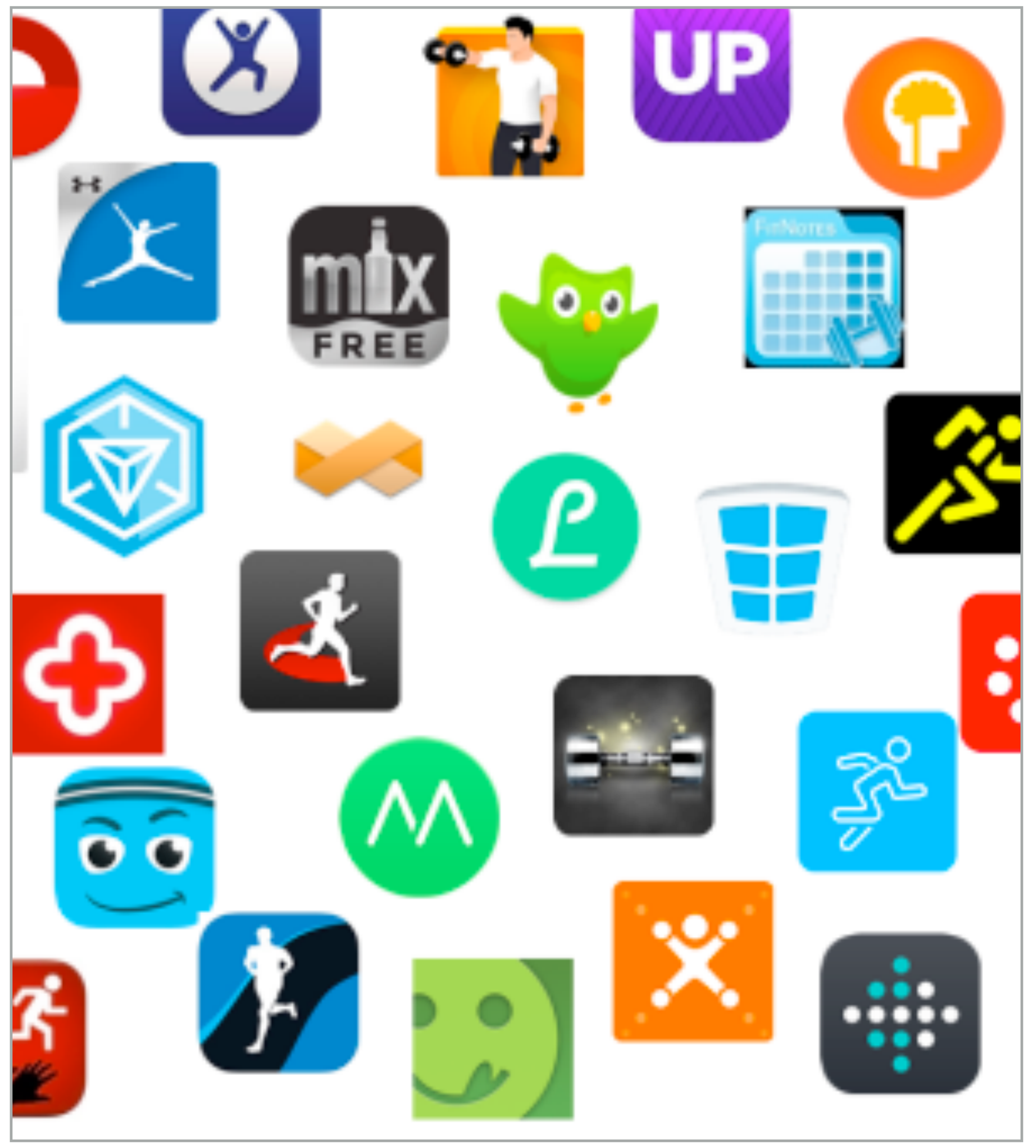
WE SERIOUSLY PAY YOU TO TRACK YOUR STEPS.

We pay you (via PayPal or direct deposits) for doing healthy things! Earn for tracking steps, sleep, meals, tweets & more! It's free to sign up for Achievement and start earning.

"My sister told me about it, and it seemed too good to be true at first. But when she said that she had already received $20, I signed up. It was so easy and a monetary motivation really

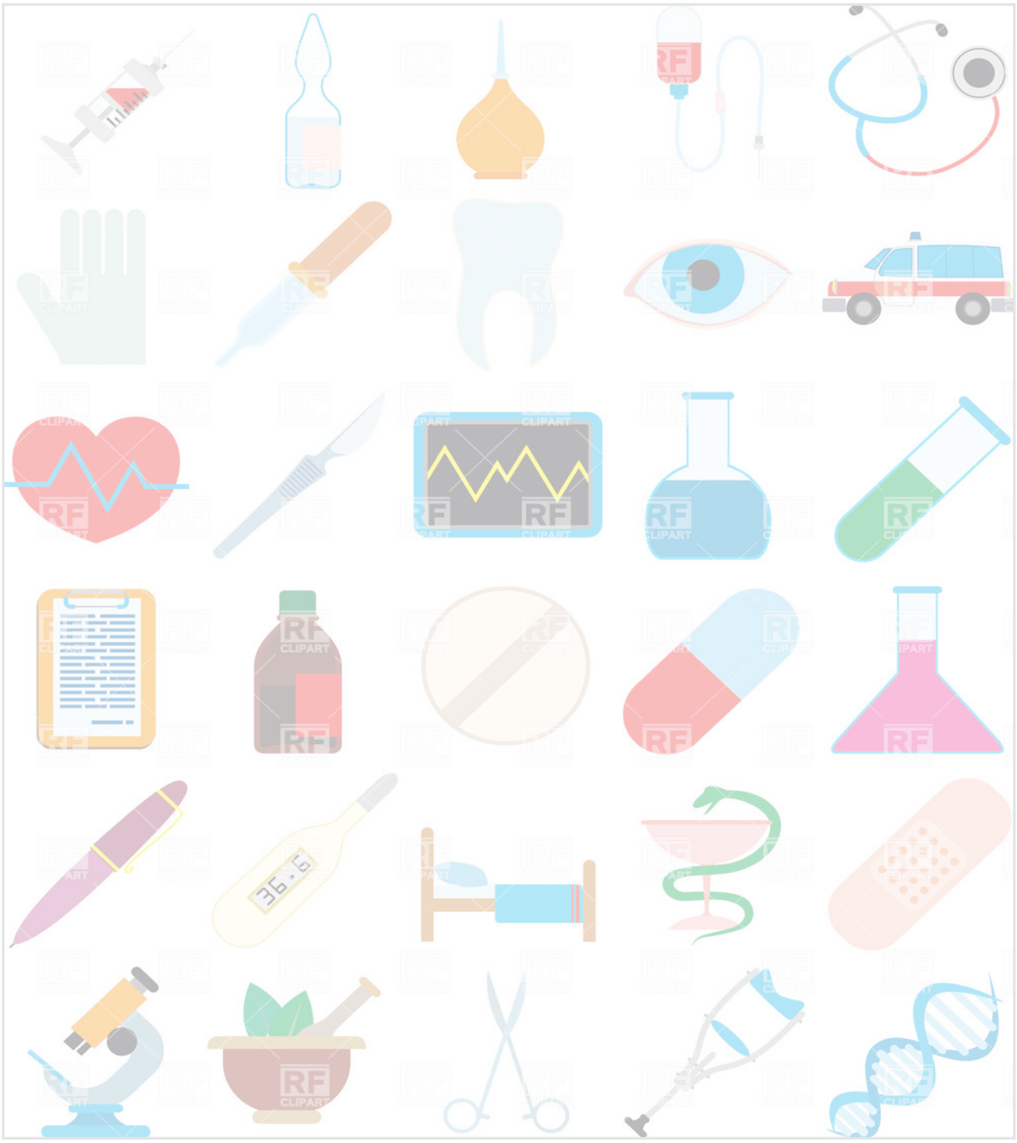
Achievement

2.8M+ Members | iOS/Android | Research



Connect
Health Apps

Earn real
Money



Participate
in Research

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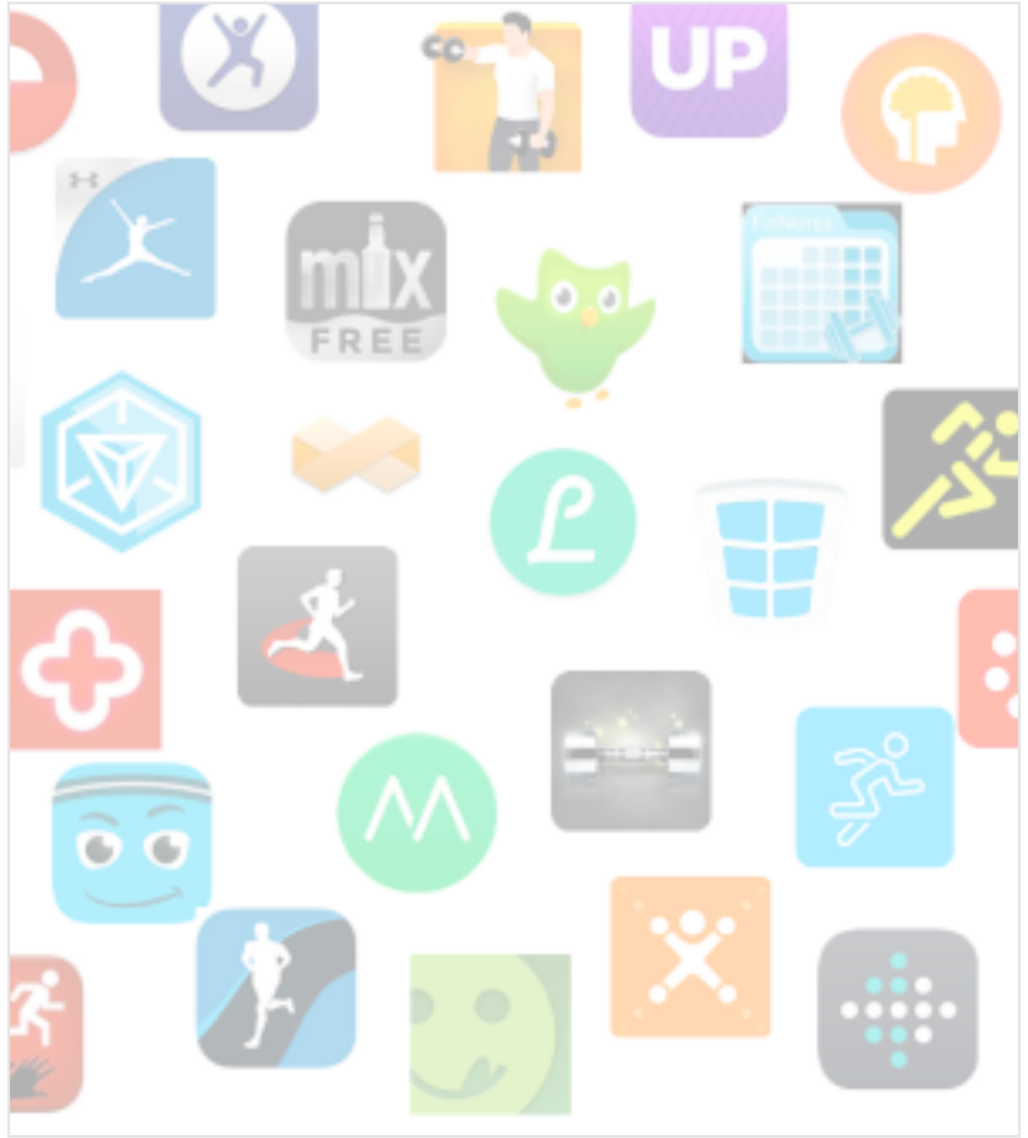
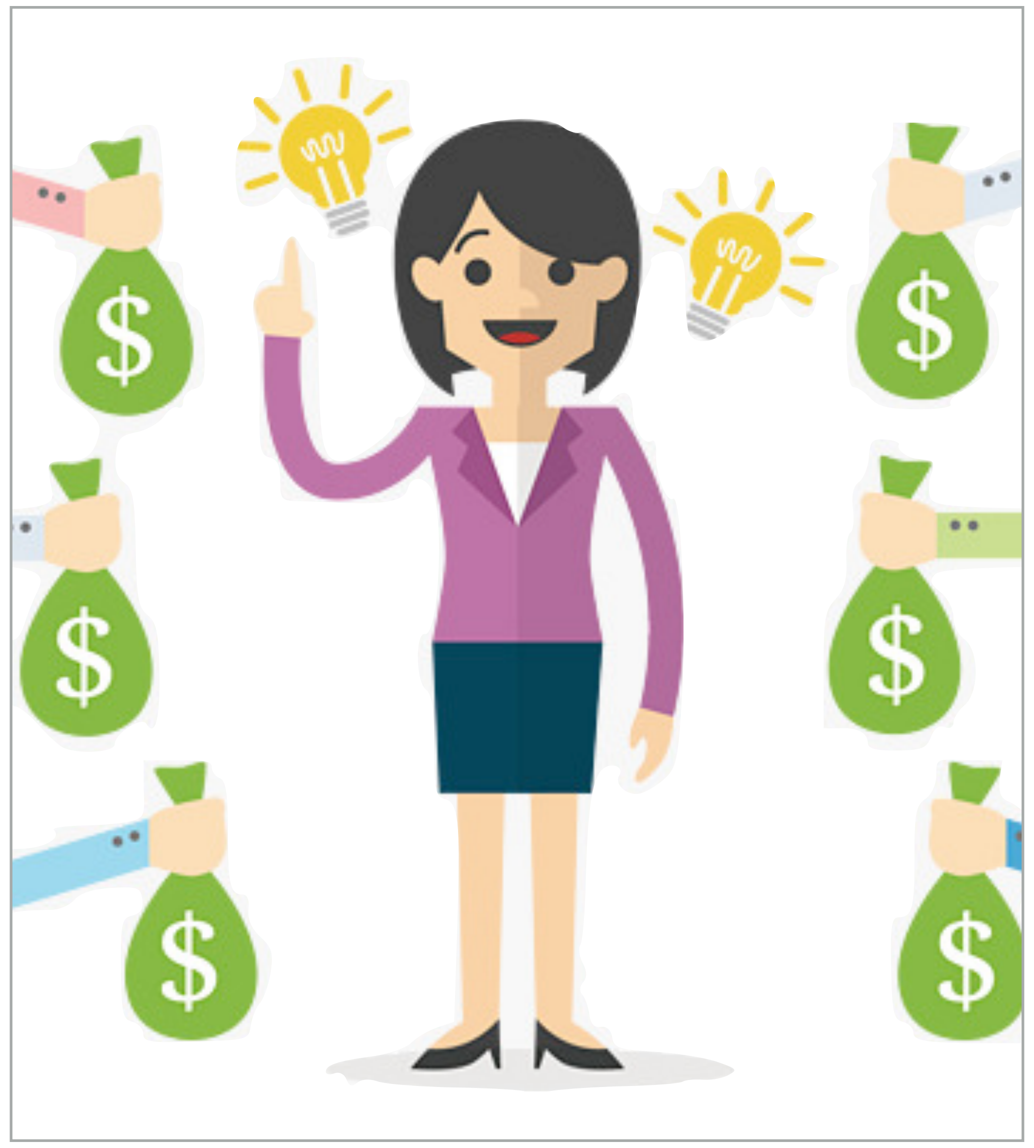
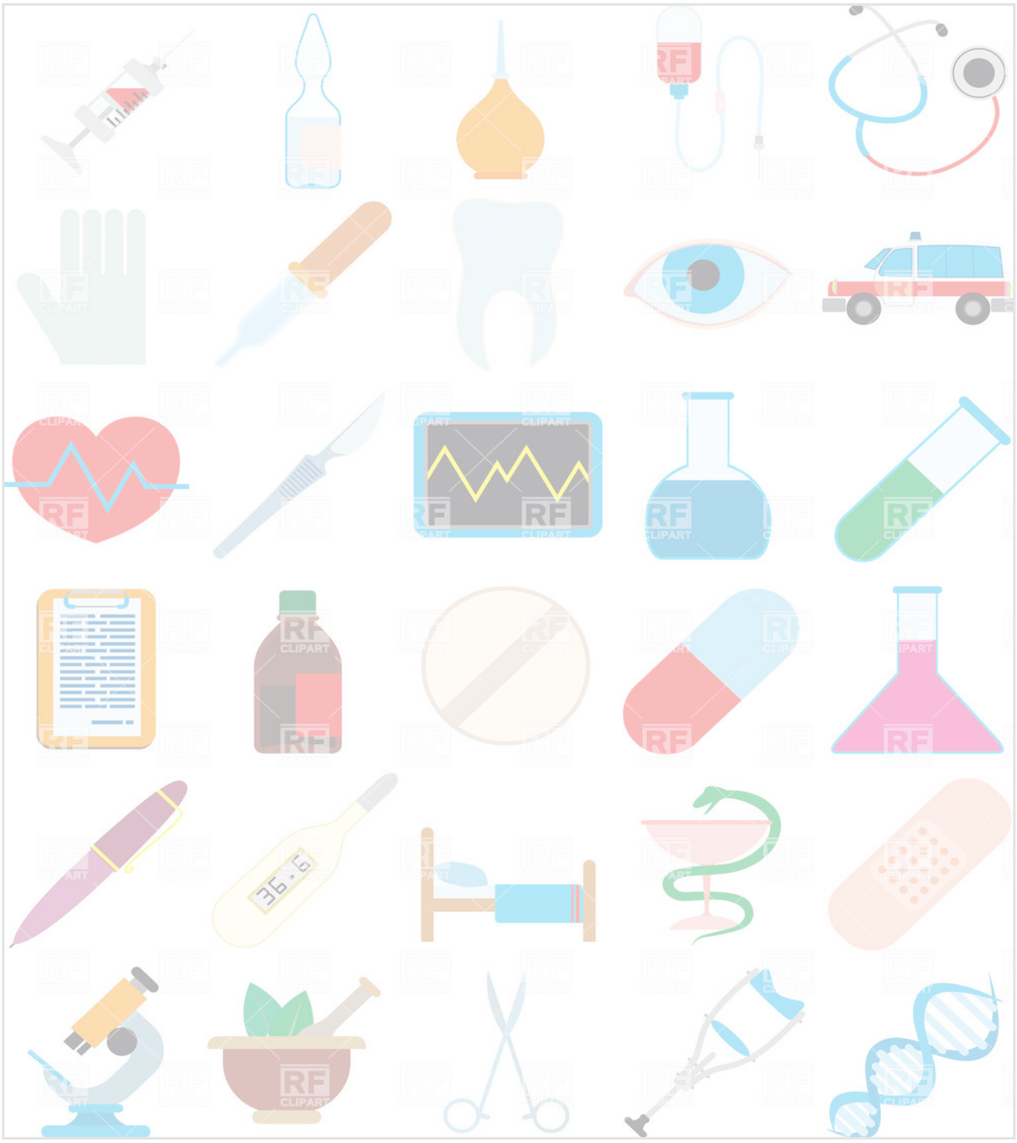


Connect
Health Apps



Earn real
Money



Participate
in Research

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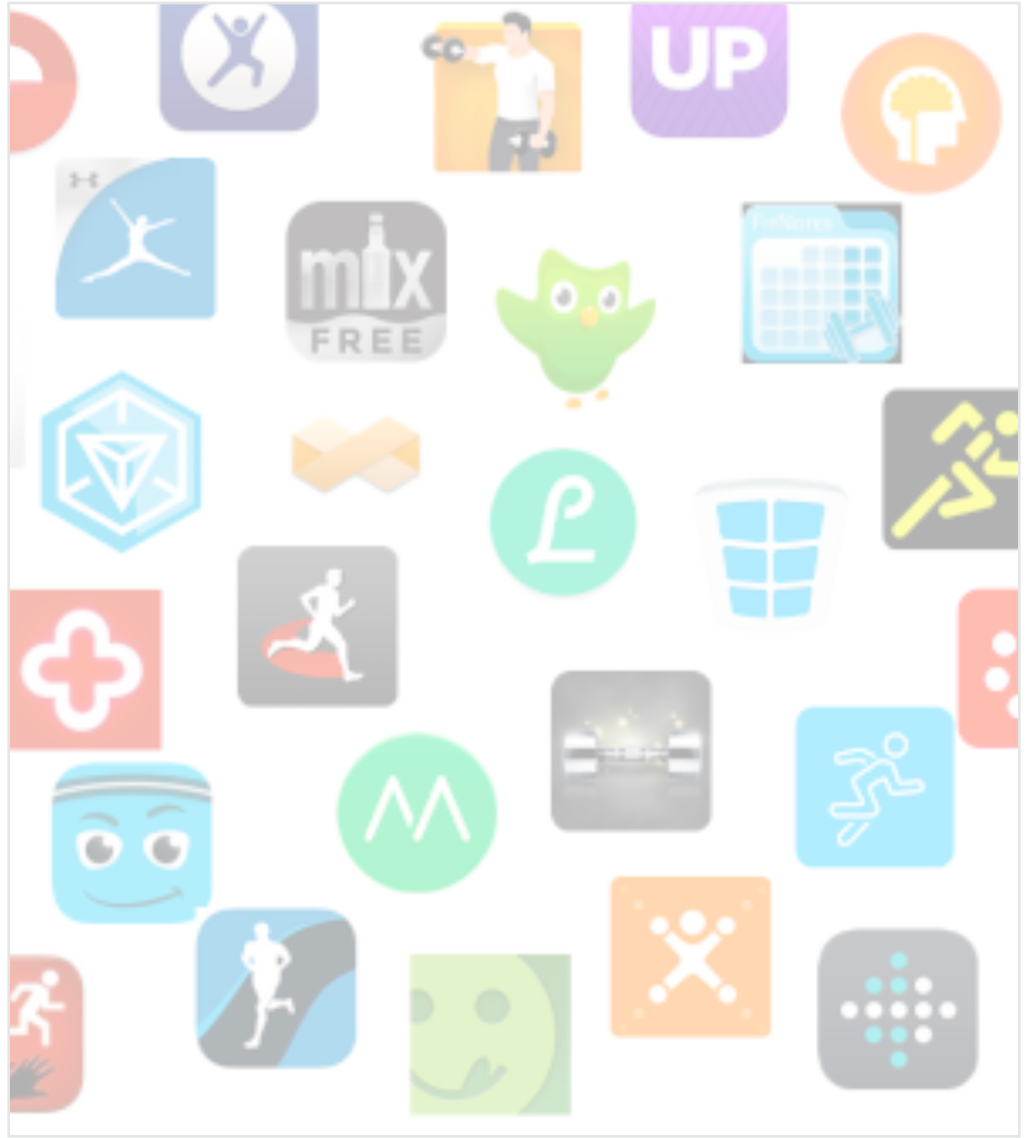
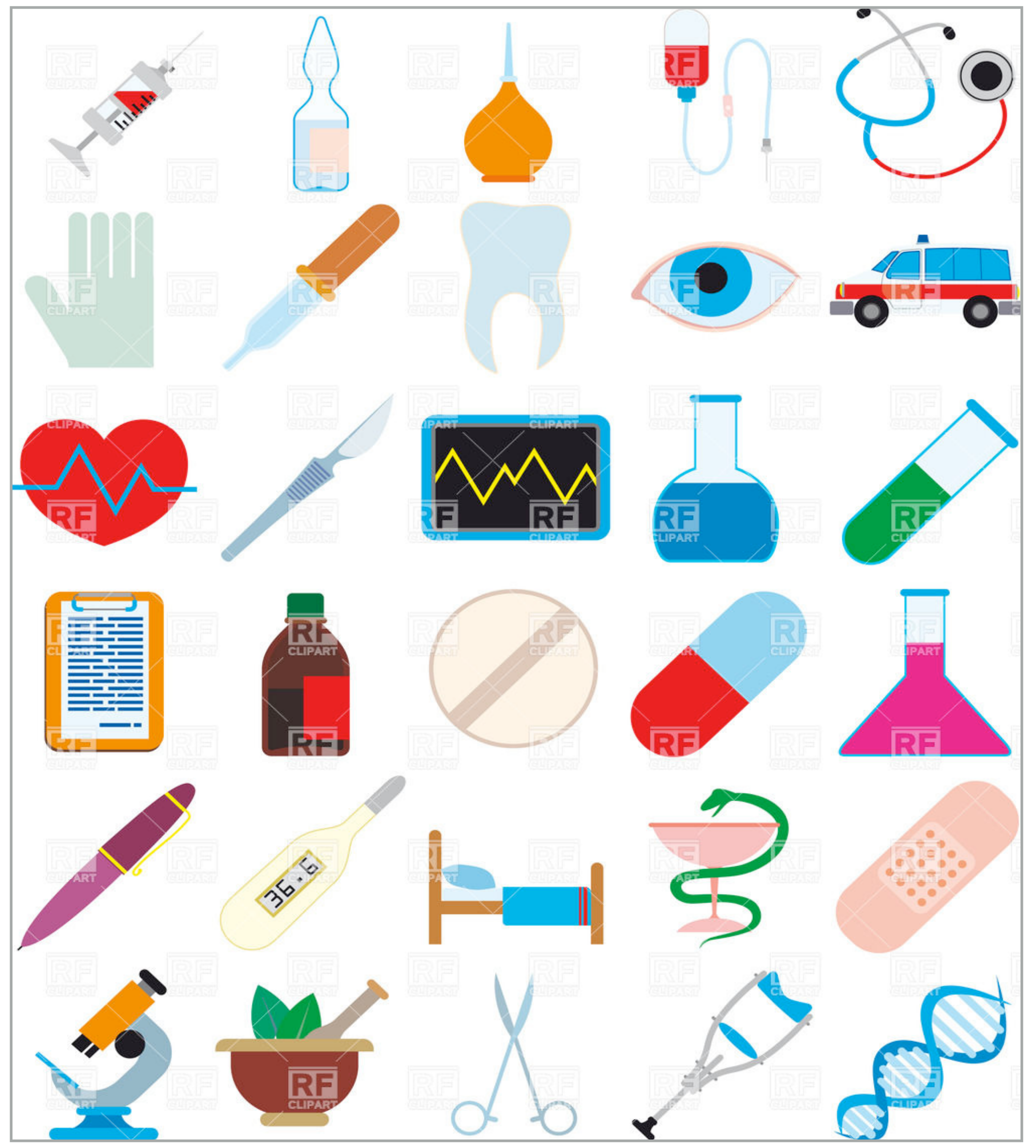


Connect
Health Apps

Earn real
Money



Participate
in Research

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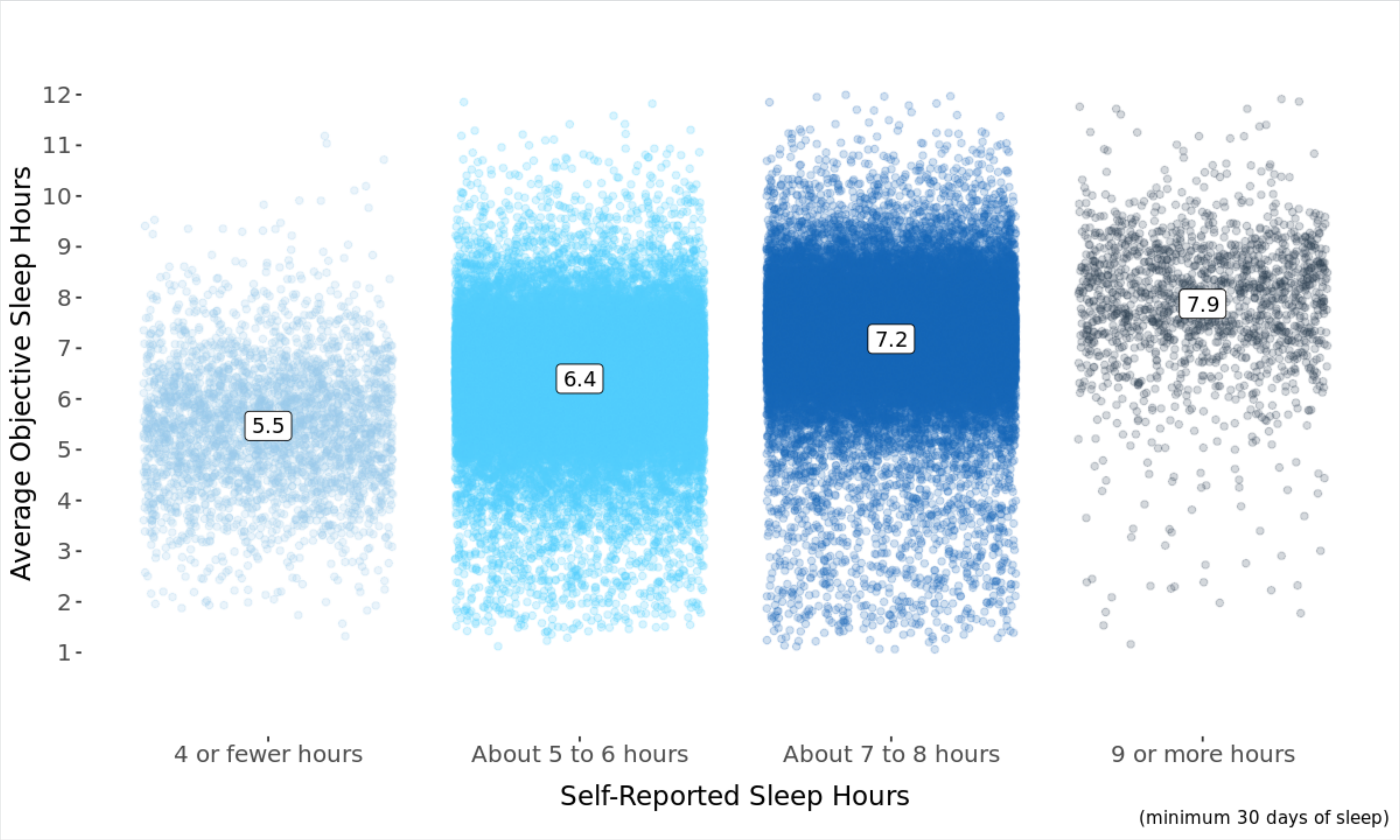
How long do you sleep?



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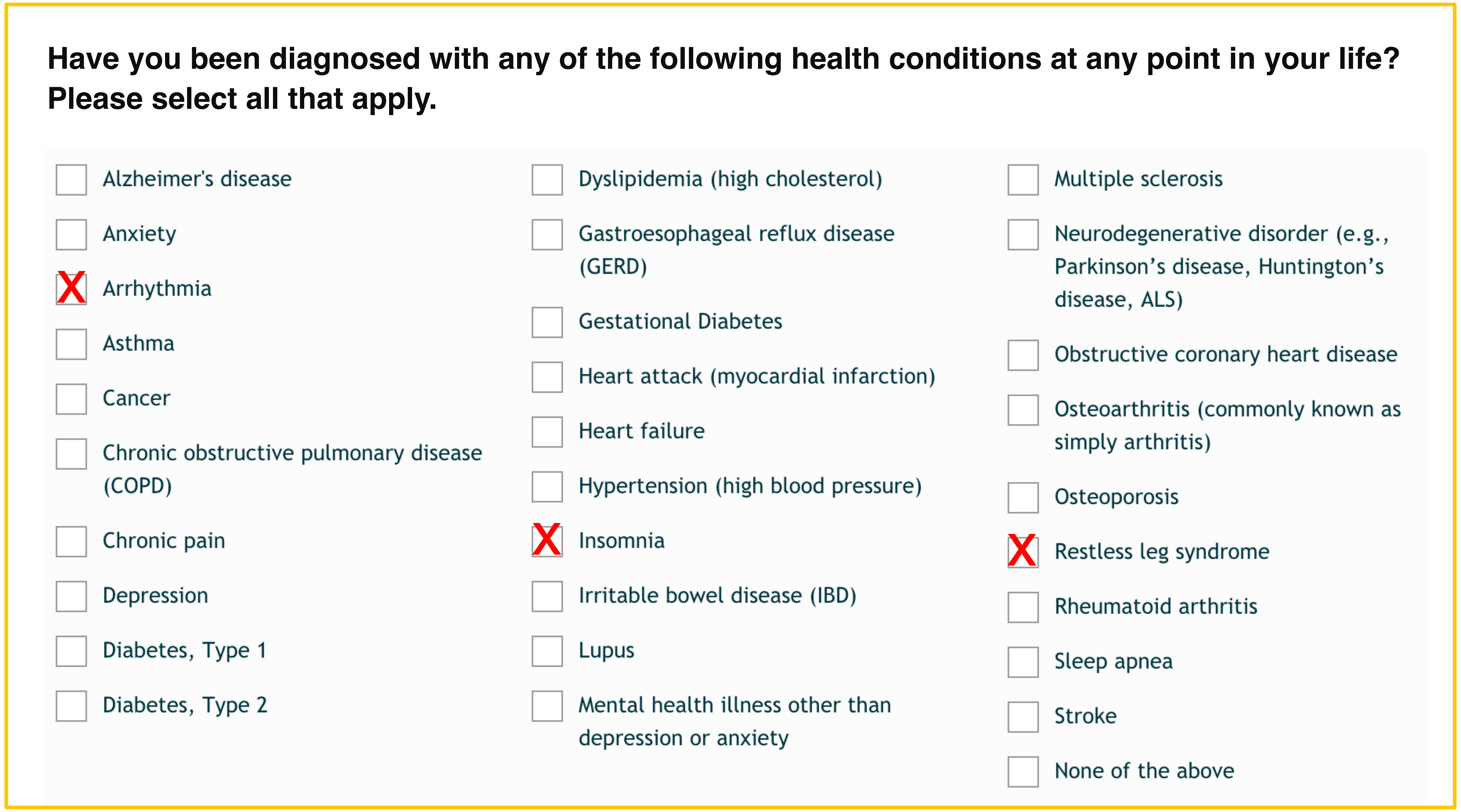


Have you been diagnosed with any of the following health conditions at any point in your life? Please select all that apply.

- ☐ Alzheimer's disease
- ☐ Anxiety
- ☒ Arrhythmia
- ☐ Asthma
- ☐ Cancer
- ☐ Chronic obstructive pulmonary disease (COPD)
- ☐ Chronic pain
- ☐ Depression
- ☐ Diabetes, Type 1
- ☐ Diabetes, Type 2
- ☐ Dyslipidemia (high cholesterol)
- ☐ Gastroesophageal reflux disease (GERD)
- ☐ Gestational Diabetes
- ☐ Heart attack (myocardial infarction)
- ☐ Heart failure
- ☐ Hypertension (high blood pressure)
- ☒ Insomnia
- ☐ Irritable bowel disease (IBD)
- ☐ Lupus
- ☐ Mental health illness other than depression or anxiety
- ☐ Multiple sclerosis
- ☐ Neurodegenerative disorder (e.g., Parkinson’s disease, Huntington’s disease, ALS)
- ☐ Obstructive coronary heart disease
- ☐ Osteoarthritis (commonly known as simply arthritis)
- ☐ Osteoporosis
- ☒ Restless leg syndrome
- ☐ Rheumatoid arthritis
- ☐ Sleep apnea
- ☐ Stroke
- ☐ None of the above

Fill out (or check) health surveys

@a_signorini

alessio@evidation.com

Published 40+ Papers

in Medical Journals and Conferences

KDD

PLOS

SOCIETY *of* BEHAVIORAL MEDICINE
Better Health Through Behavior Change

INTERNATIONAL SOCIETY FOR PHARMACOECONOMICS AND OUTCOMES RESEARCH
ISPOR

AMA
AMERICAN MEDICAL ASSOCIATION

Annals of Internal Medicine®

acm
Association for Computing Machinery

Journal of Medical Internet Research
JMIR Publicatons

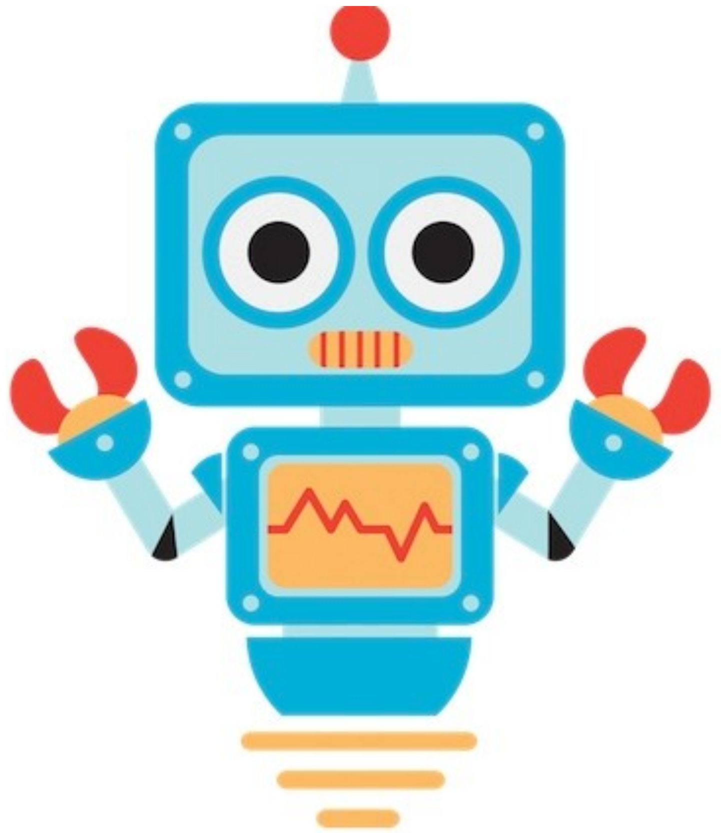
NIPS
Neural Information Processing Systems Foundation™

American Diabetes Association®
77TH SCIENTIFIC SESSIONS
SAN DIEGO, CA • JUNE 9 - 13, 2017

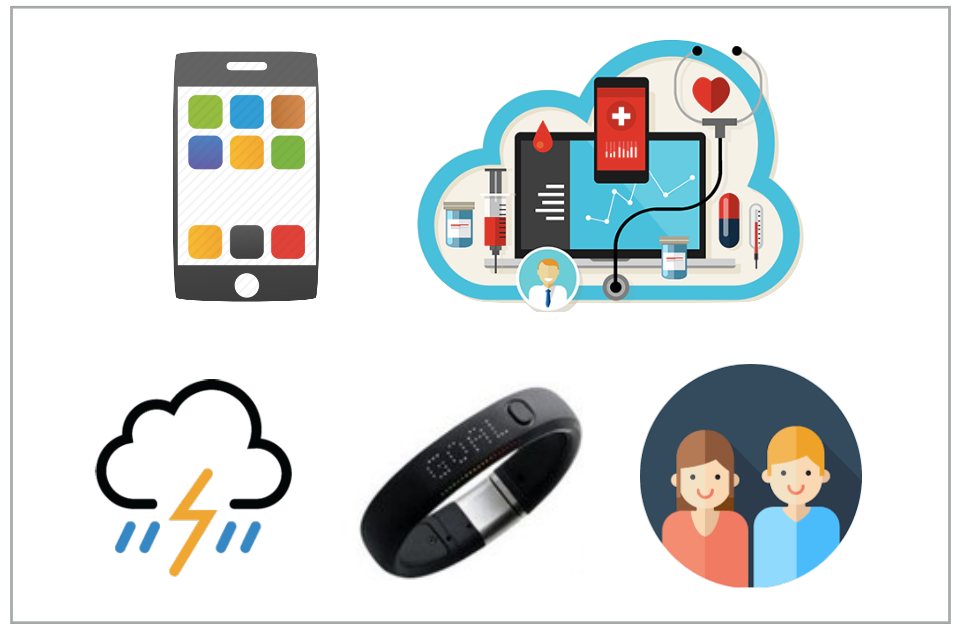
AMERICAN COLLEGE OF CARDIOLOGY
ACC.17™
66th Annual Scientific Session & Expo

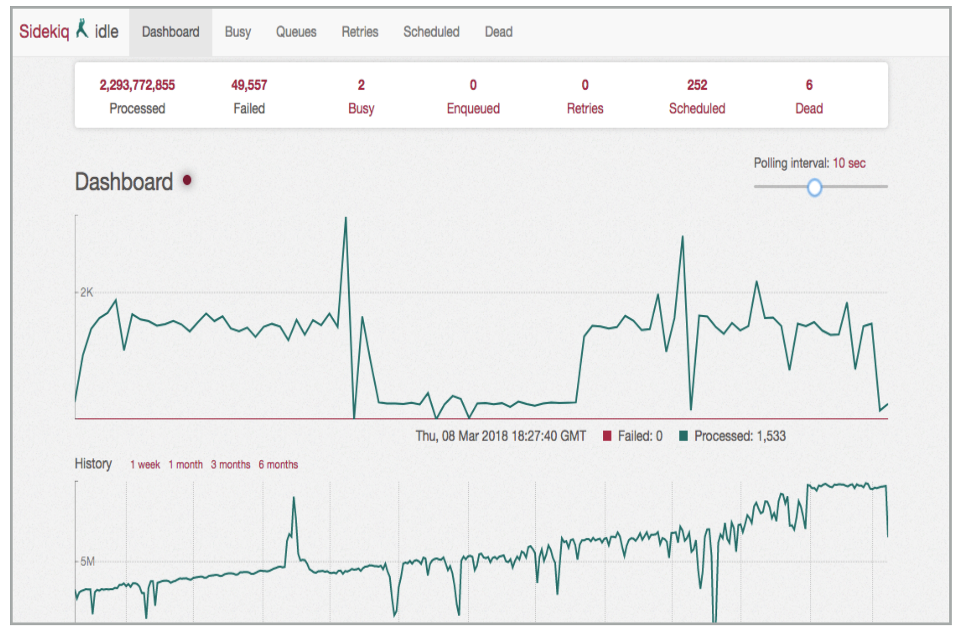
SMDM
Society for Medical Decision Making

evidation.com/research



How do we do it?




Sidekiq
idle
Dashboard
Busy
Queues
Retries
Scheduled
Dead

2,293,772,855 Processed
49,557 Failed
2 Busy
0 Enqueued
0 Retries
252 Scheduled
6 Dead

Dashboard

Polling interval: 10 sec

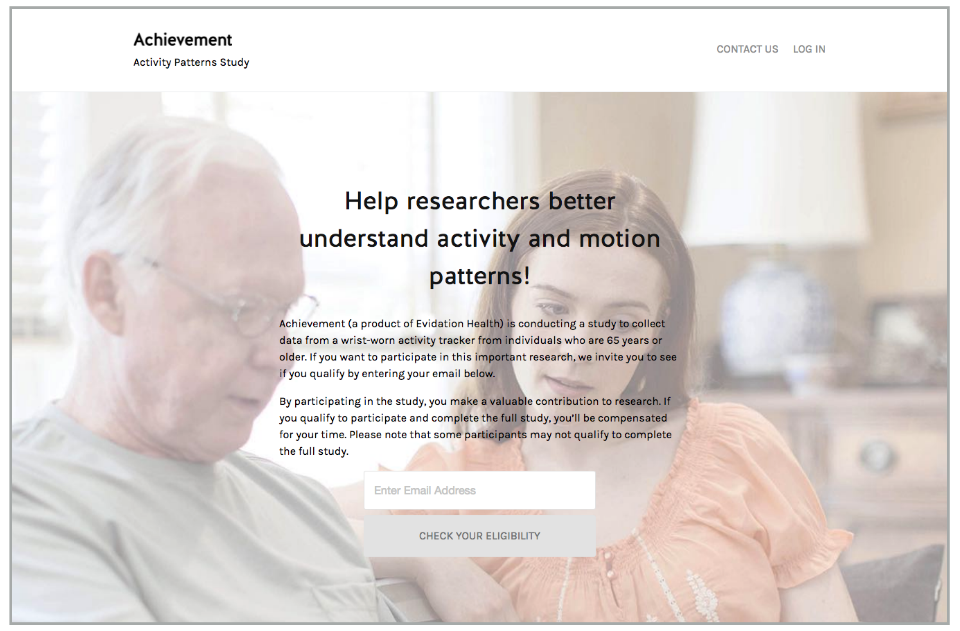
2K

Thu, 08 Mar 2018 18:27:40 GMT ■ Failed: 0 ■ Processed: 1,533

History
1 week
1 month
3 months
6 months
5M

Data Connectivity

100+ Devices/Apps
Highly Scalable
Weather, Census, EMR


Achievement
Activity Patterns Study

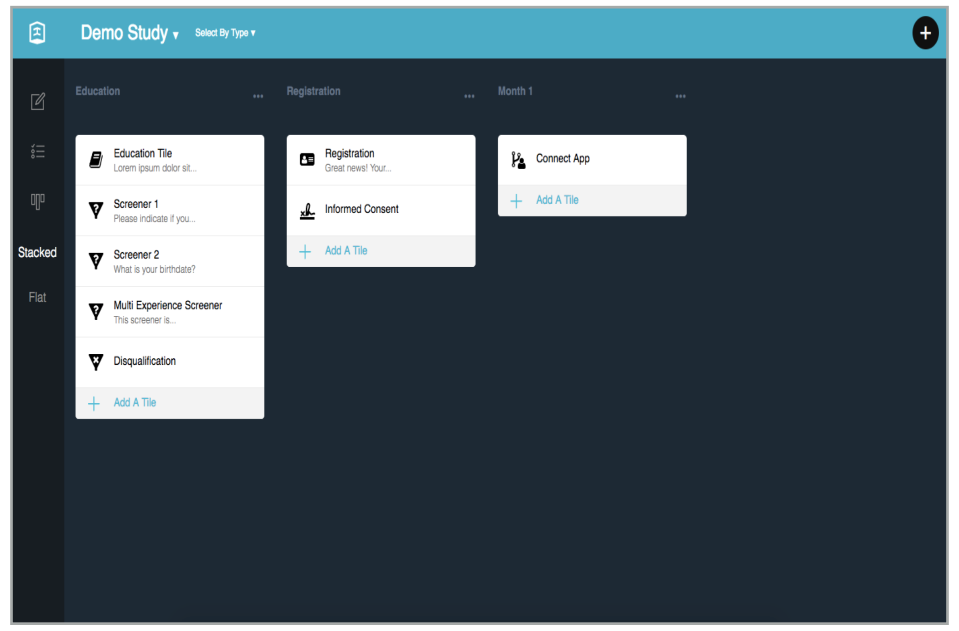
CONTACT US
LOG IN

Help researchers better understand activity and motion patterns!

Achievement (a product of Evidation Health) is conducting a study to collect data from a wrist-worn activity tracker from individuals who are 65 years or older. If you want to participate in this important research, we invite you to see if you qualify by entering your email below.

By participating in the study, you make a valuable contribution to research. If you qualify to participate and complete the full study, you'll be compensated for your time. Please note that some participants may not qualify to complete the full study.

Enter Email Address
CHECK YOUR ELIGIBILITY


Demo Study ▾
Select By Type ▾
Stacked
Flat

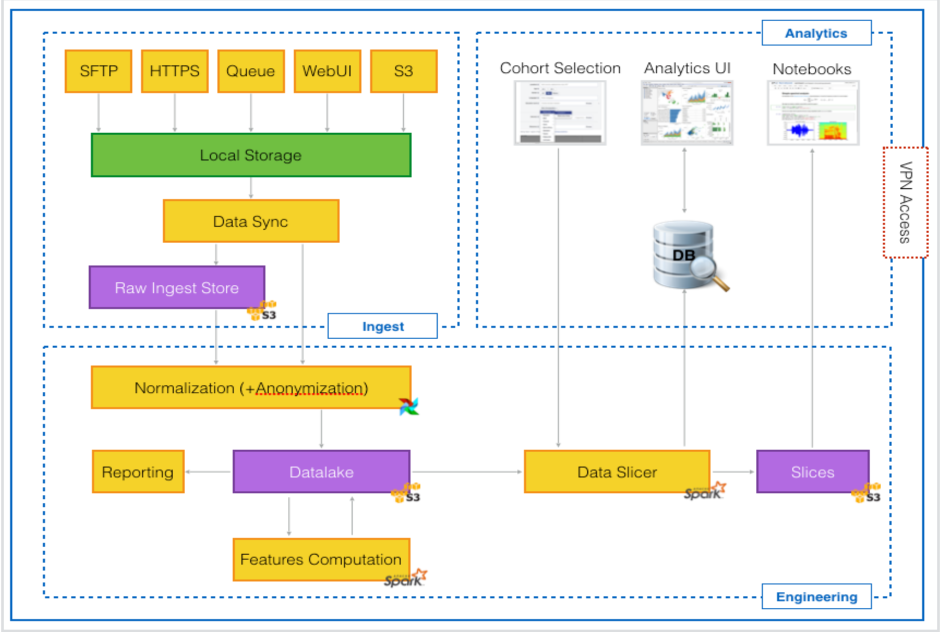
Education
- Education Tile — Lorem ipsum dolor sit...
- Screener 1 — Please indicate if you...
- Screener 2 — What is your birthdate?
- Multi Experience Screener — This screener is...
- Disqualification
- Add A Tile

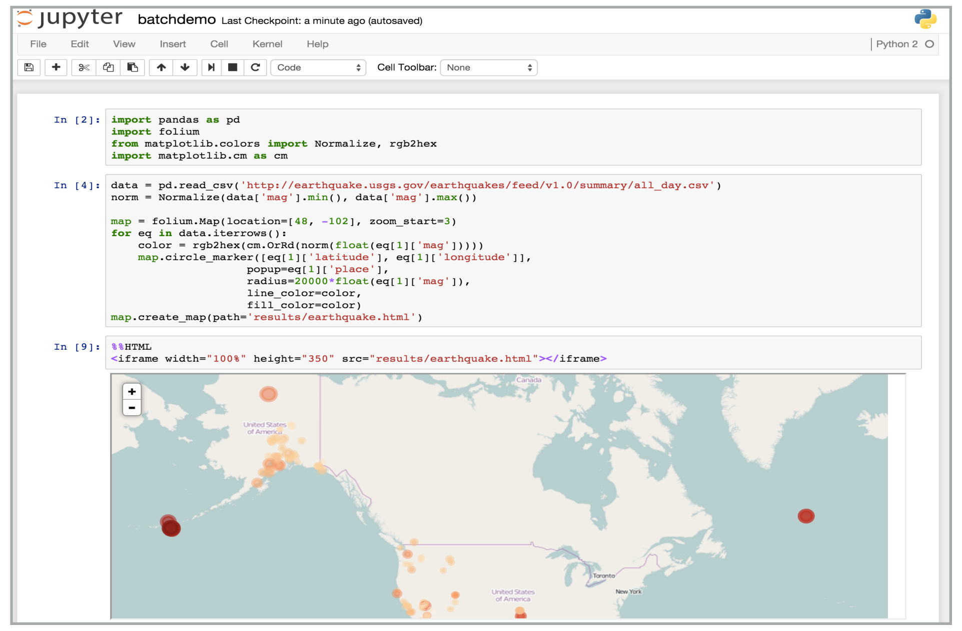
Registration
- Registration — Great news! Your...
- Informed Consent
- Add A Tile

Month 1
- Connect App
- Add A Tile

Study Management

Design, Management
Multi-Site, Physical/Virtual
Protocol + IRB Approval


SFTP
HTTPS
Queue
WebUI
S3
Local Storage
Data Sync
Raw Ingest Store
S3
Ingest
Cohort Selection
Analytics UI
Notebooks
Analytics
DB
VPN Access
Normalization (+Anonymization)
Reporting
Datalake
S3
Data Slicer
Spark
Slices
S3
Features Computation
Spark
Engineering


jupyter
batchdemo Last Checkpoint: a minute ago (autosaved)
File
Edit
View
Insert
Cell
Kernel
Help
Python 2
Code
Cell Toolbar: None
Canada
United States of America

```
In [2]: import pandas as pd
        import folium
        from matplotlib.colors import Normalize, rgb2hex
        import matplotlib.cm as cm

In [4]: data = pd.read_csv('http://earthquake.usgs.gov/earthquakes/feed/v1.0/summary/all_day.csv')
        norm = Normalize(data['mag'].min(), data['mag'].max())

        map = folium.Map(location=[48, -102], zoom_start=3)
        for eq in data.iterrows():
            color = rgb2hex(cm.OrRd(norm(float(eq[1]['mag']))))
            map.circle_marker([eq[1]['latitude'], eq[1]['longitude']],
                              popup=eq[1]['place'],
                              radius=20000*float(eq[1]['mag']),
                              line_color=color,
                              fill_color=color)
        map.create_map(path='results/earthquake.html')

In [9]: %%HTML
        <iframe width="100%" height="350" src="results/earthquake.html"></iframe>
```

Analysis Platform

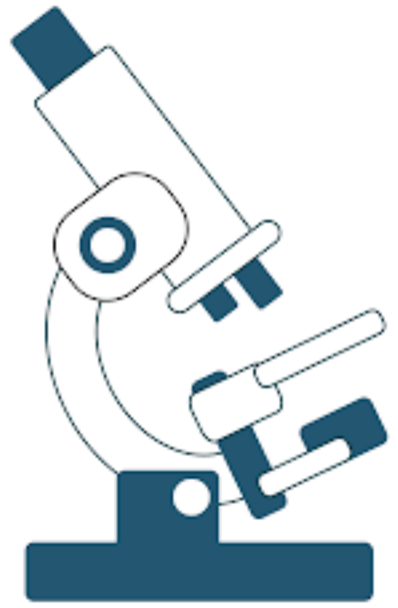
HIPAA Compliant
Exploration & Research
Python, R, MATLAB

Our Partners

Pharma

Hospitals

Payers



Organizations

Prospective | Retrospective | Observational
Controlled Trials | Virtual | Physical

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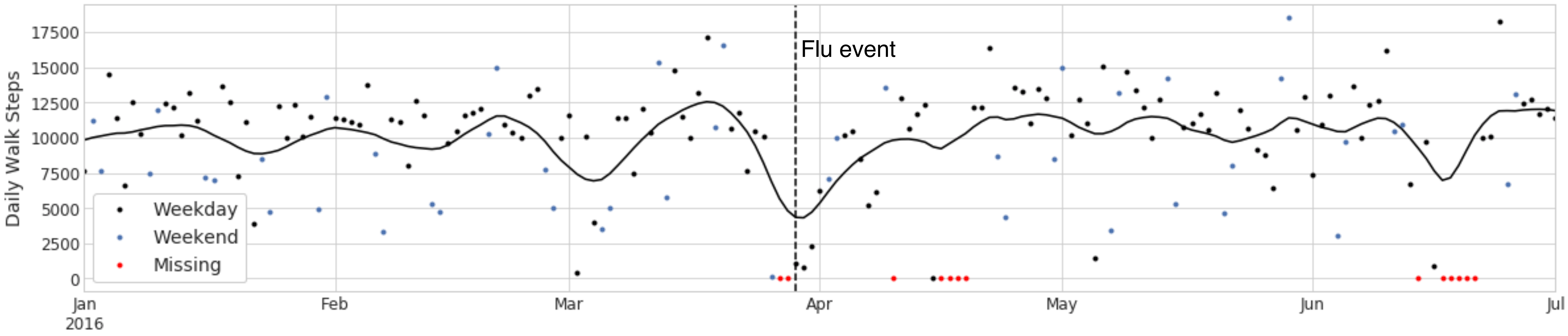
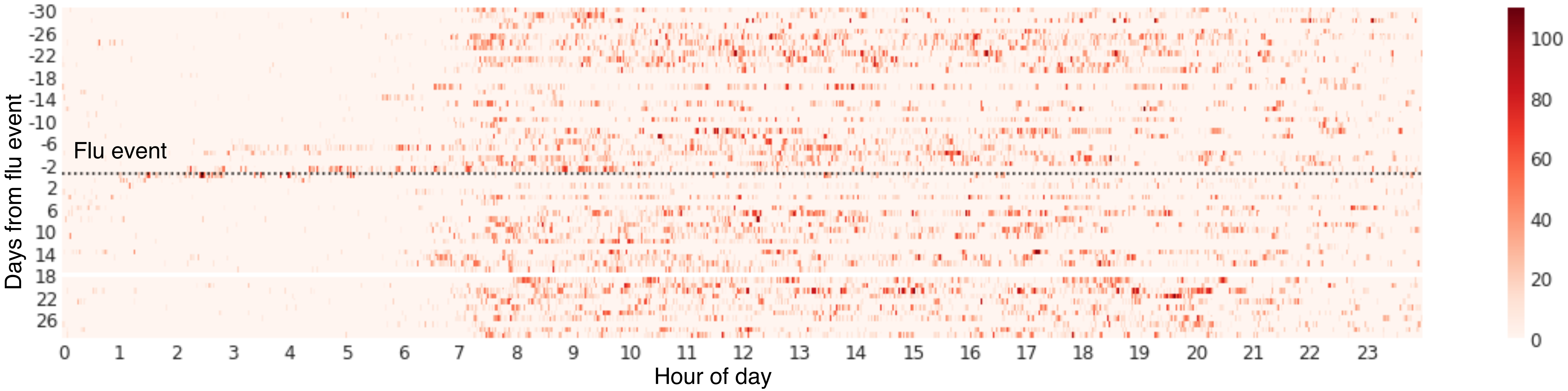
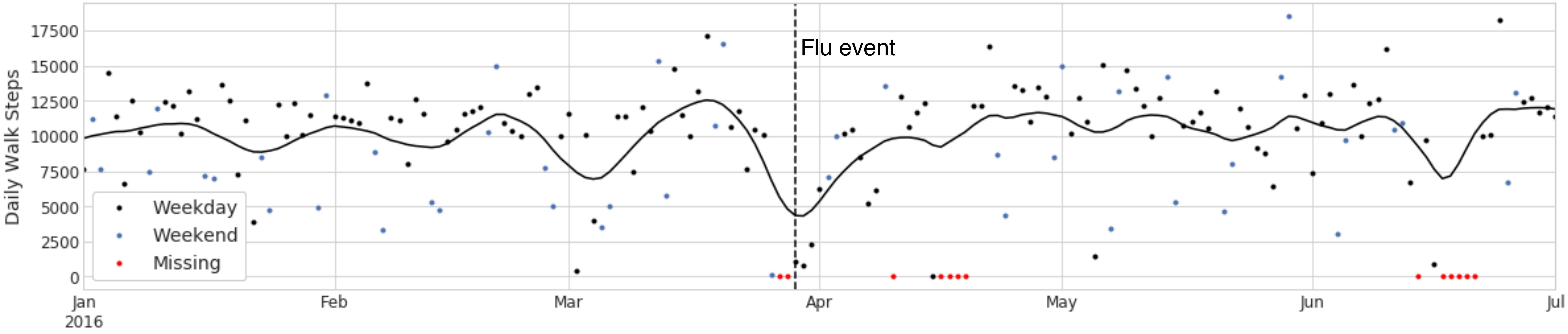


Daily step counts for a person with diabetes



Step count each minute for a person with diabetes

Daily step counts for a person with diabetes



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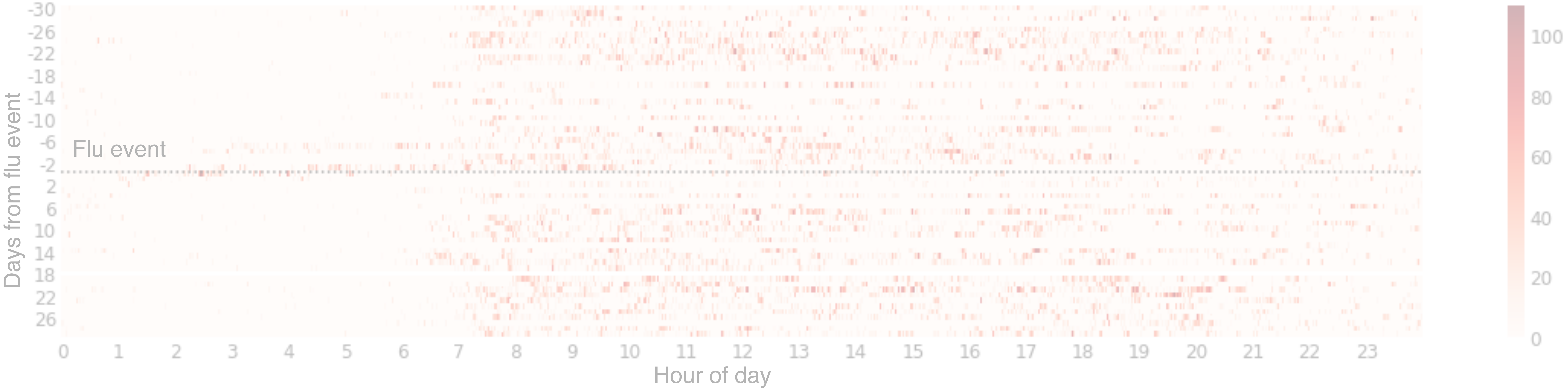

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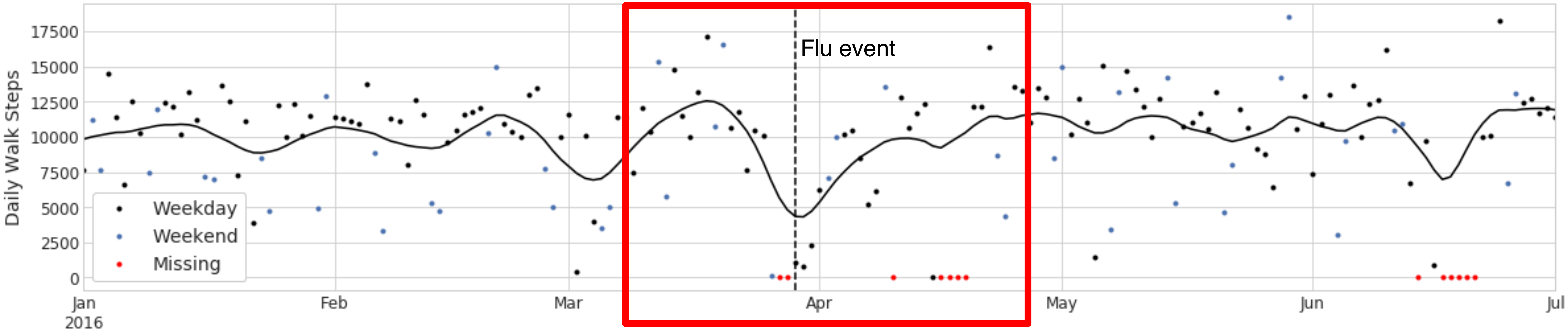

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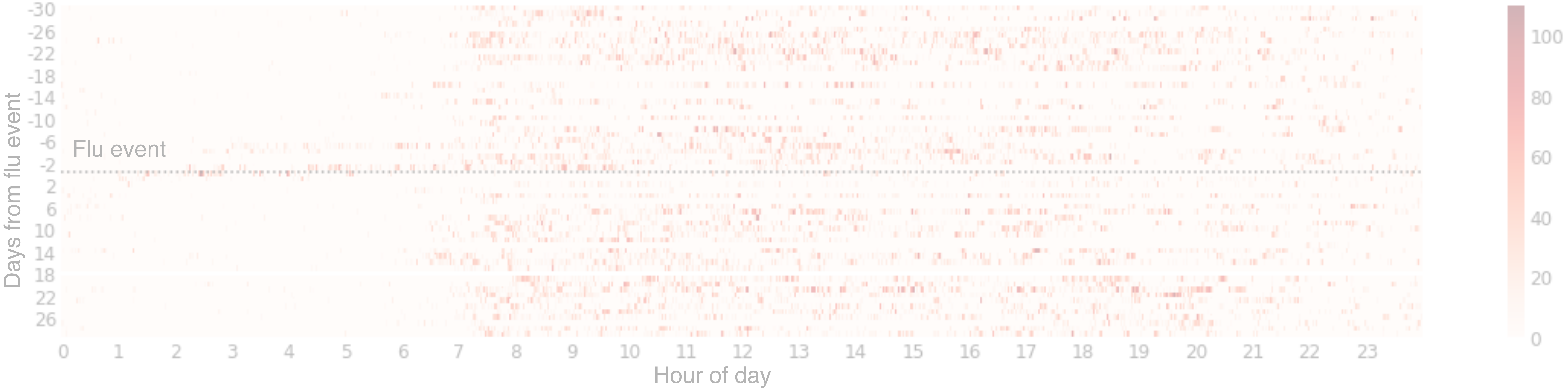

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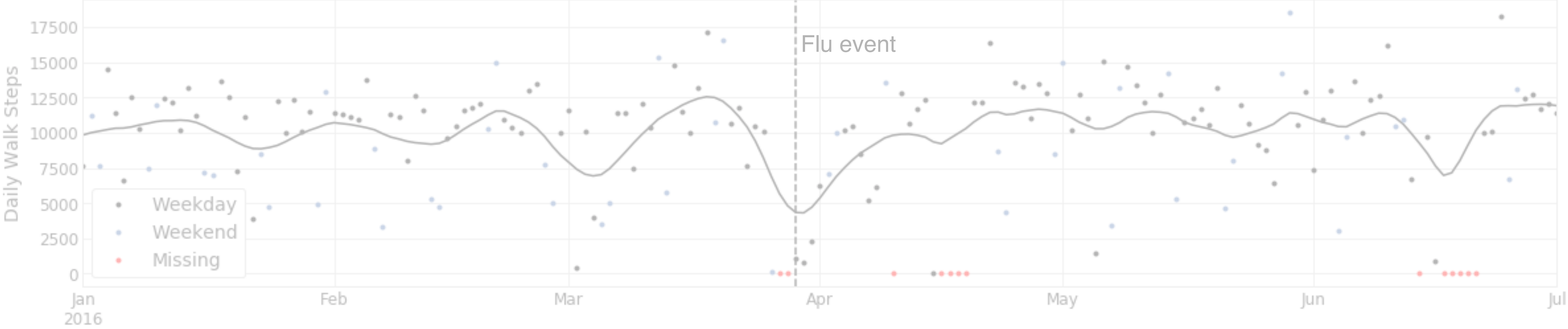

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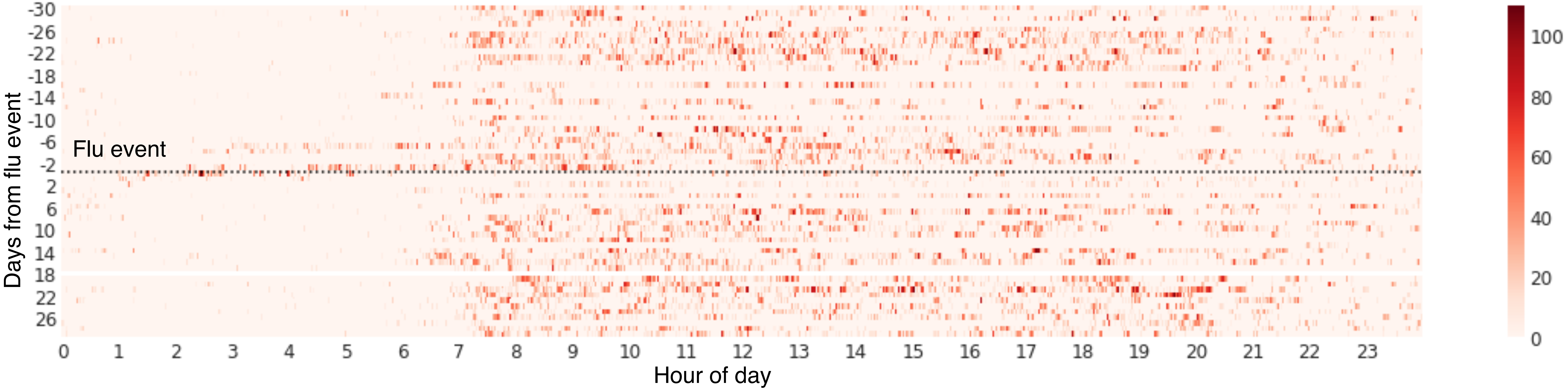

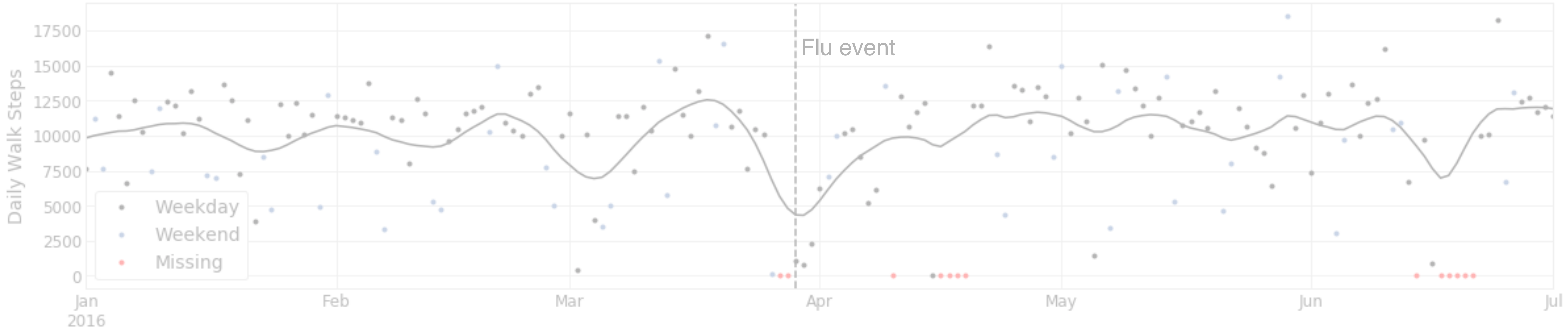

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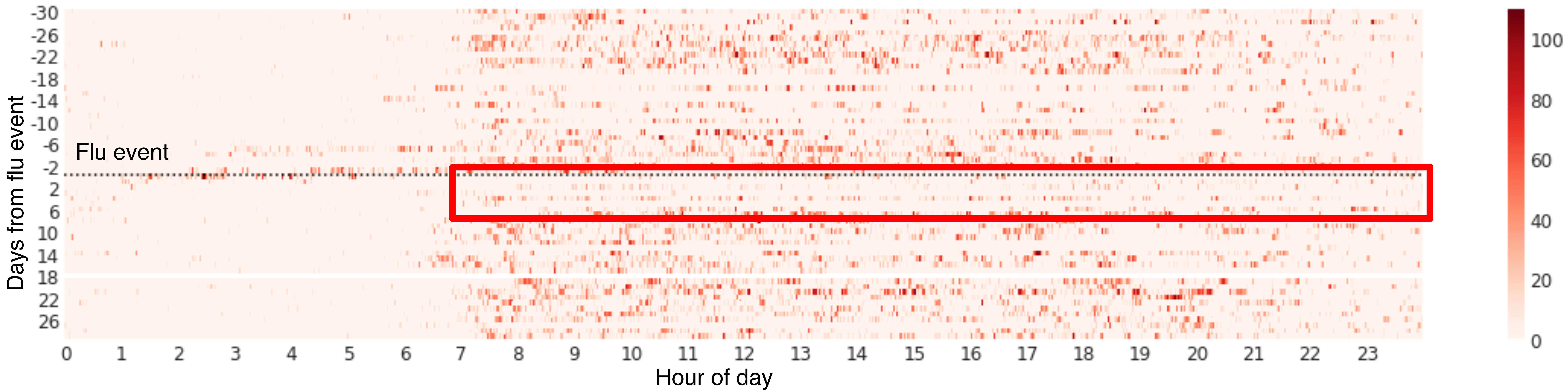

Step count each minute for a person with diabetes

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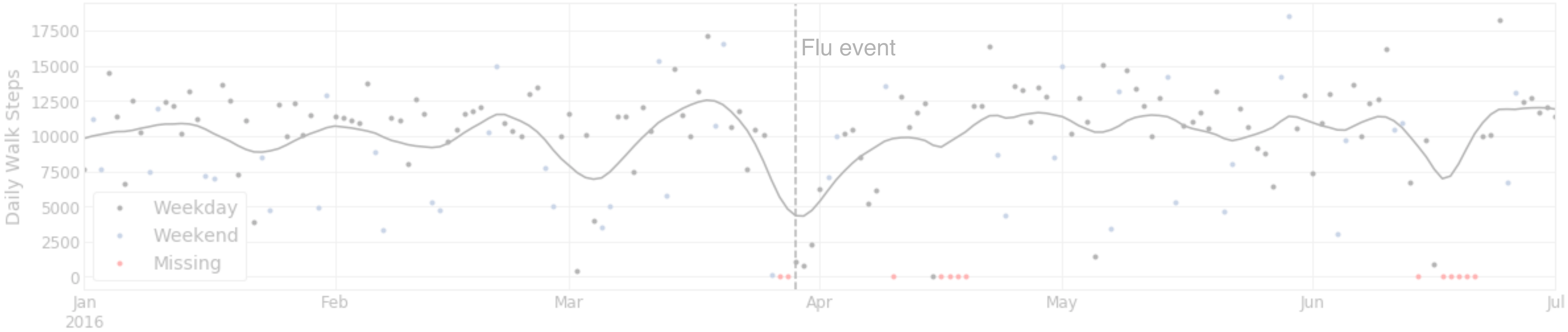
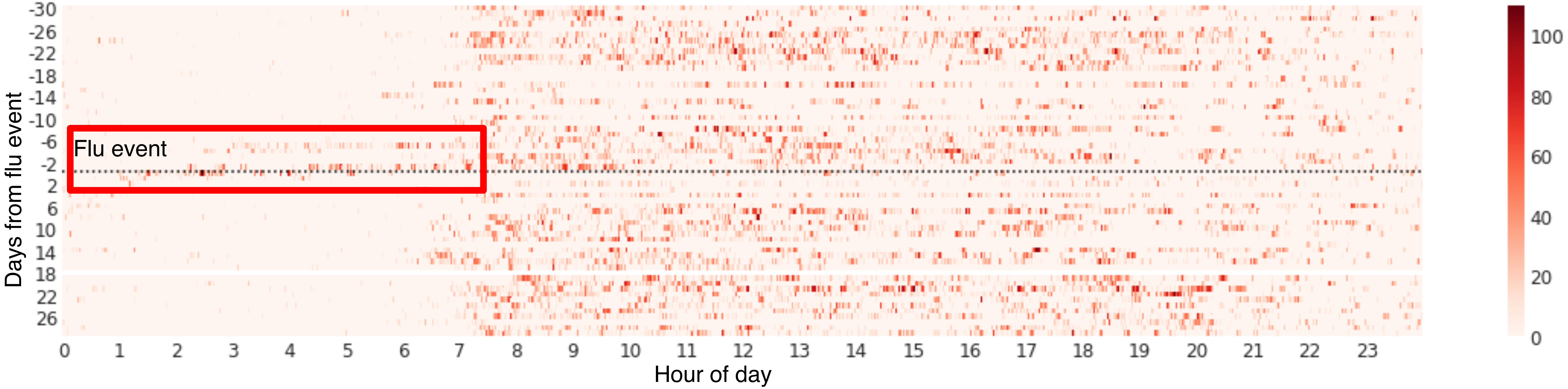
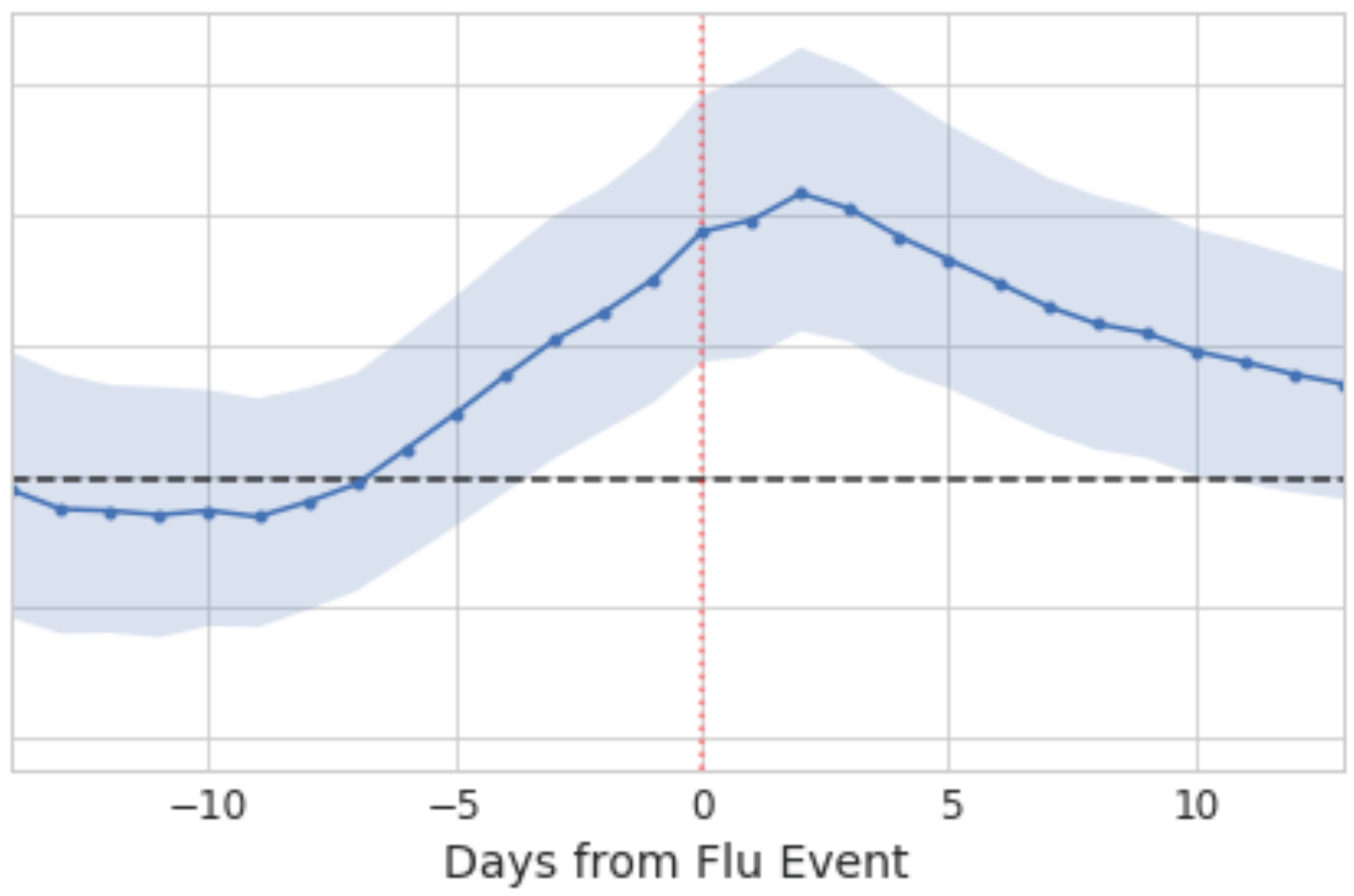
Daily step counts for a person with diabetes



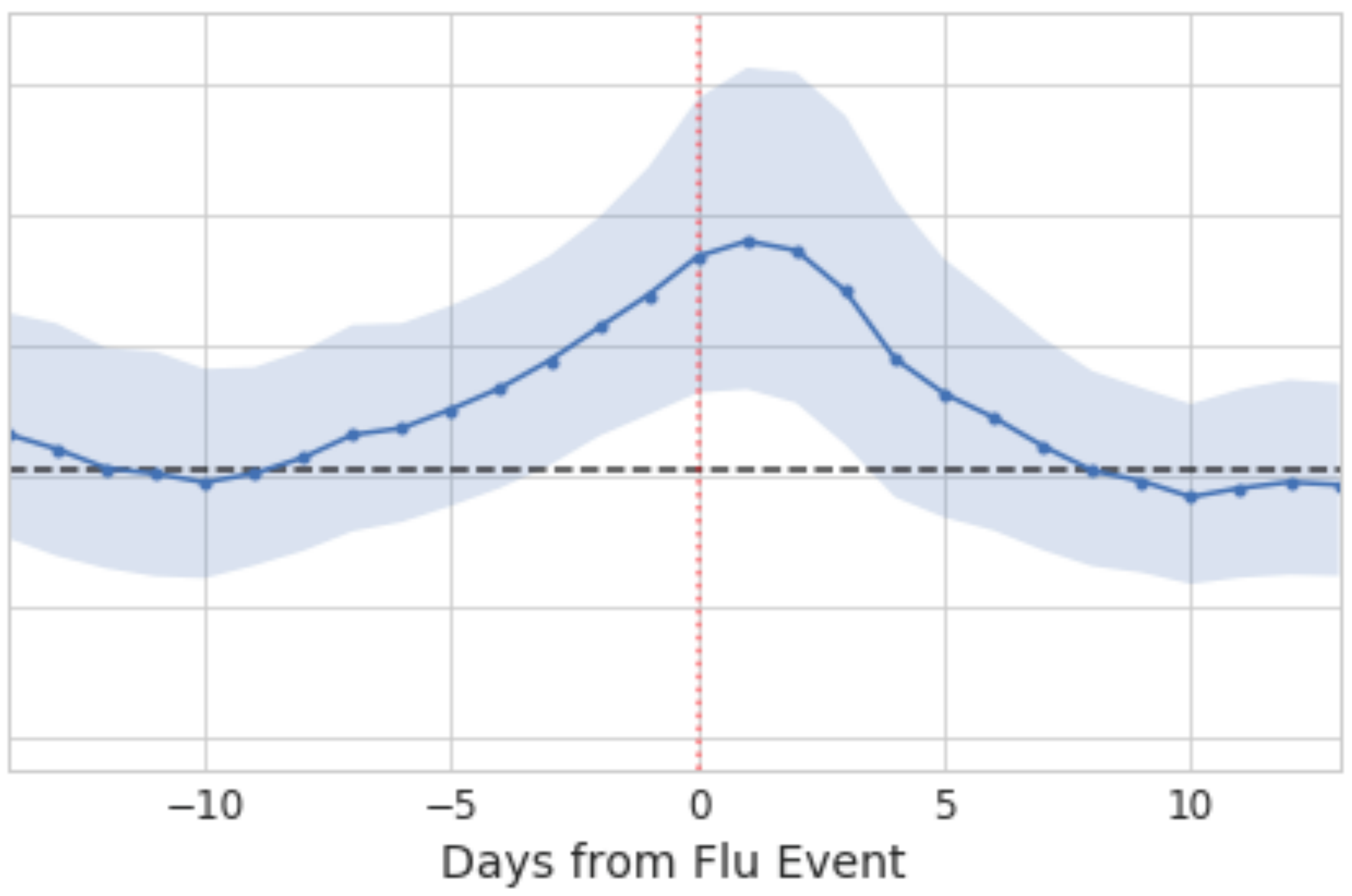
Step count each minute for a person with diabetes

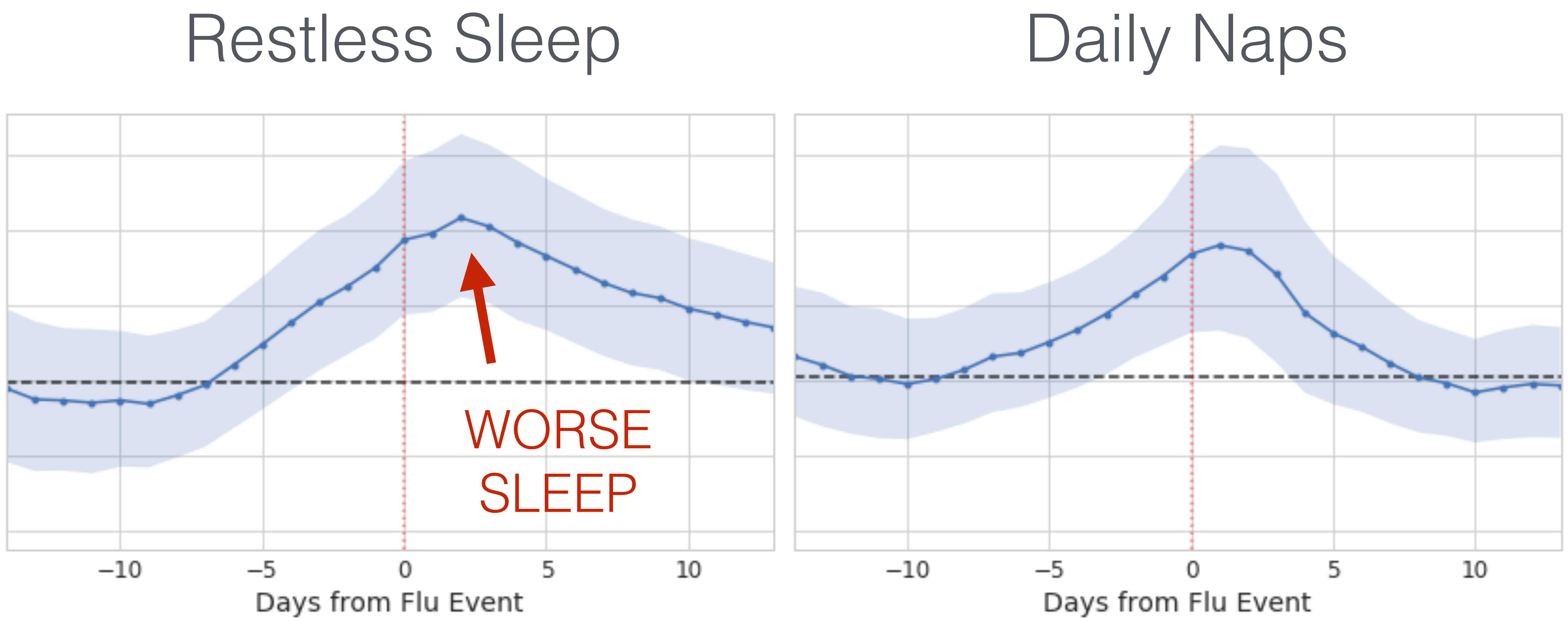


Restless Sleep



Daily Naps





WORSE SLEEP

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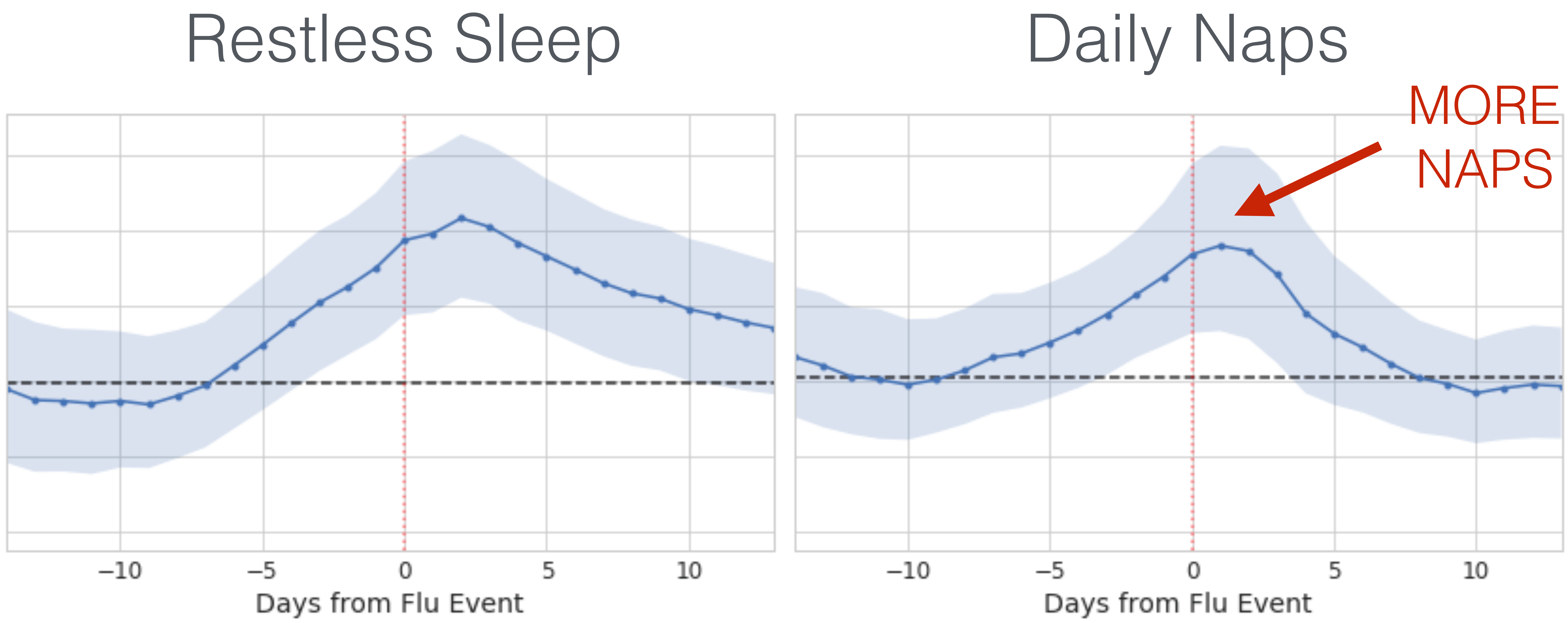
Restless Sleep
Daily Naps
−10
−5
0
5
10
Days from Flu Event
−10
−5
0
5
10
Days from Flu Event

MORE NAPS

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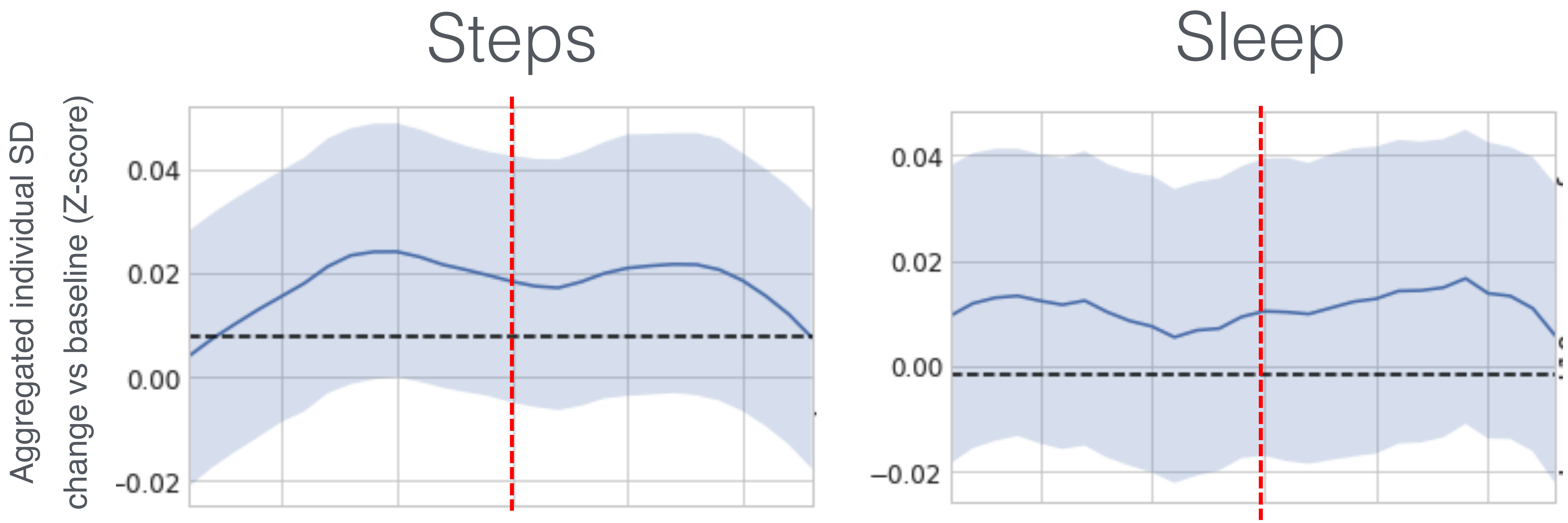
Effects of Flu Vaccine



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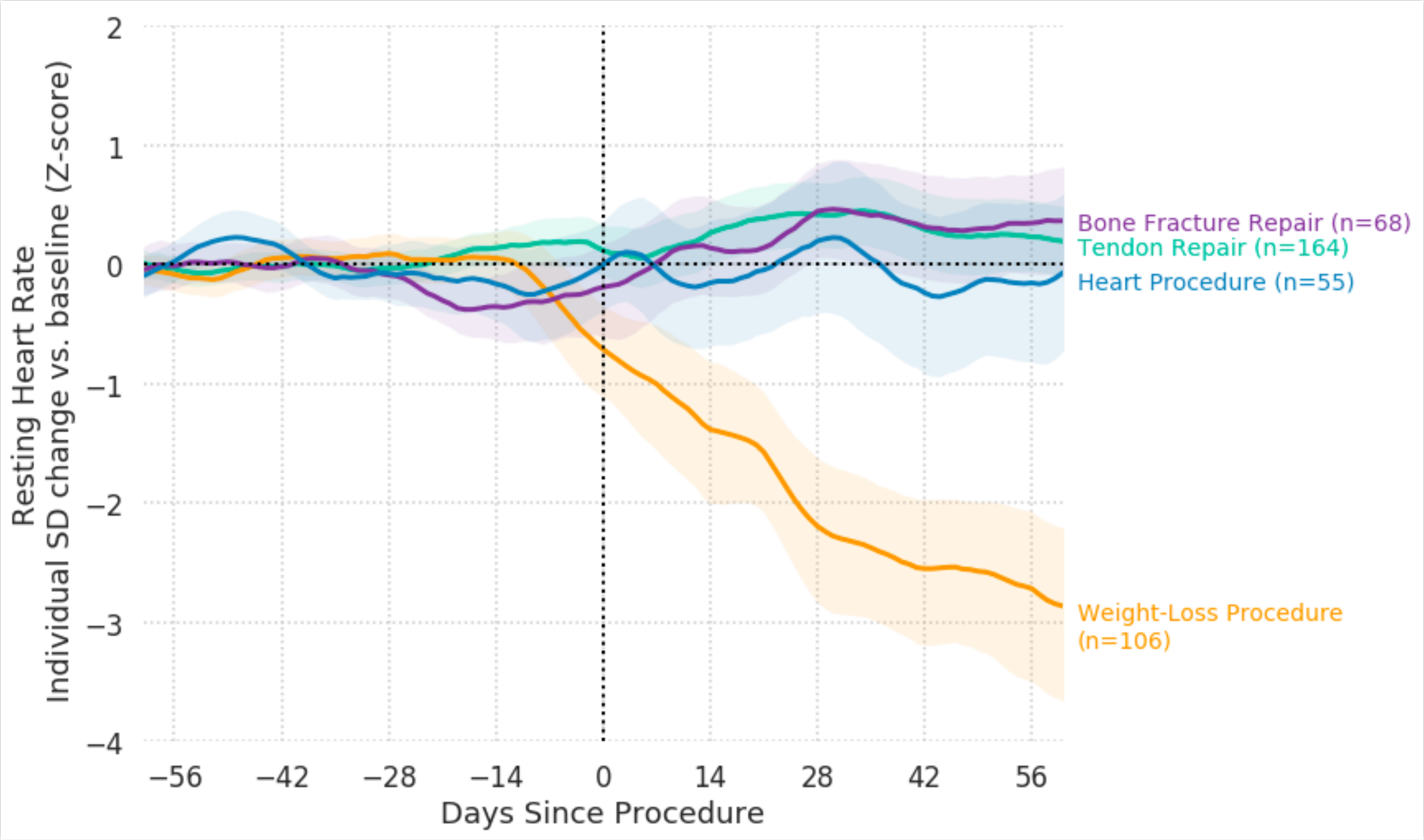
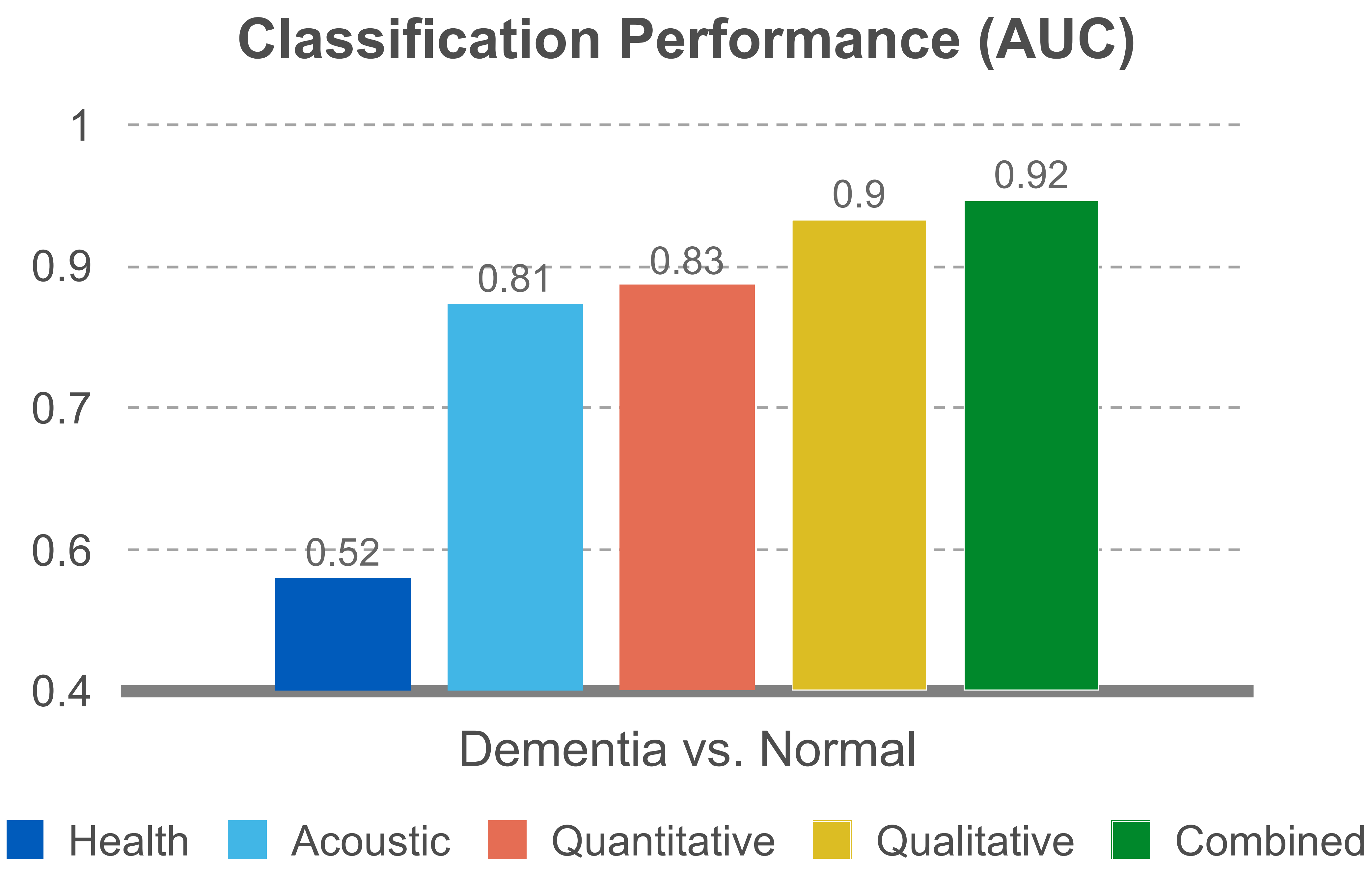


Heart-rate after Procedure



Measure Cognitive Decline using Voice-based Digital Biomarker

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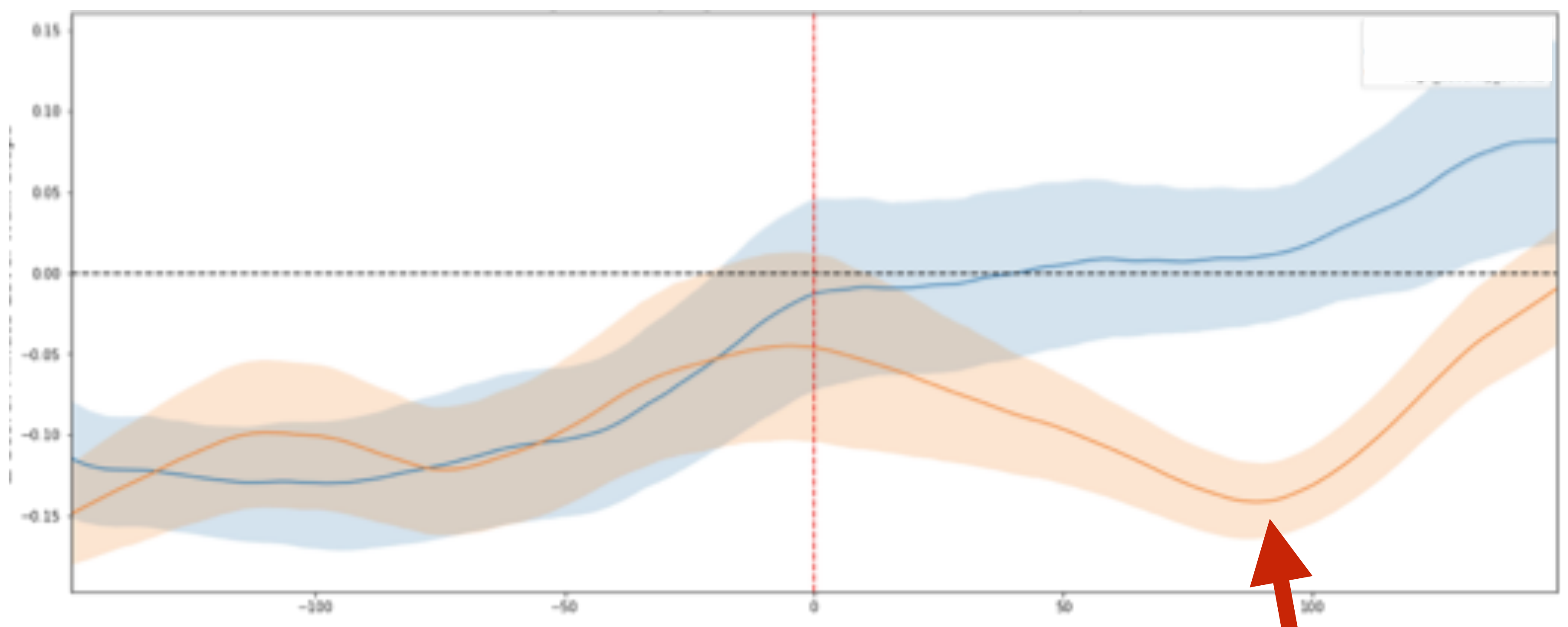
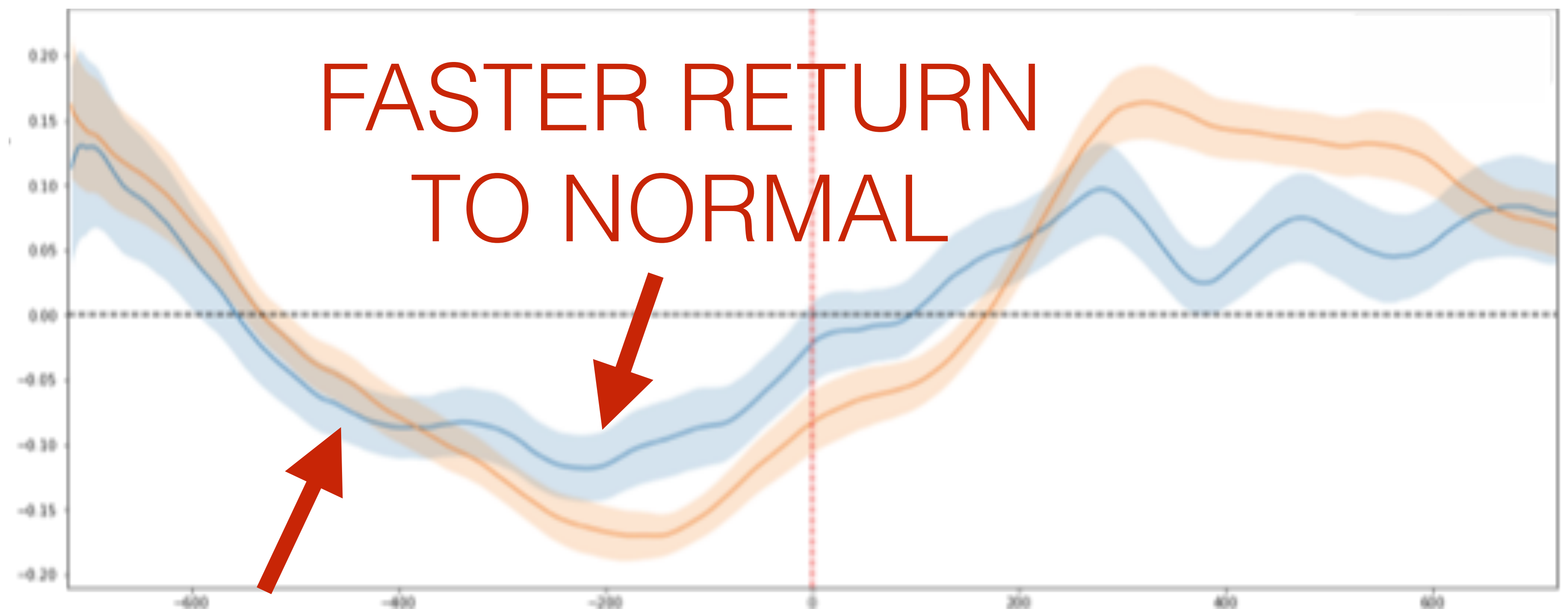
Migraine Biomarker

Compared to Control Day



REDUCED ACTIVITY

Medicated vs. not



FASTER RETURN TO NORMAL

REAL MEDICATION

Digital Biomarkers for

COPD Progression

MS Progression

Migraine Probability & Events

Vaccination Probability & Effectiveness

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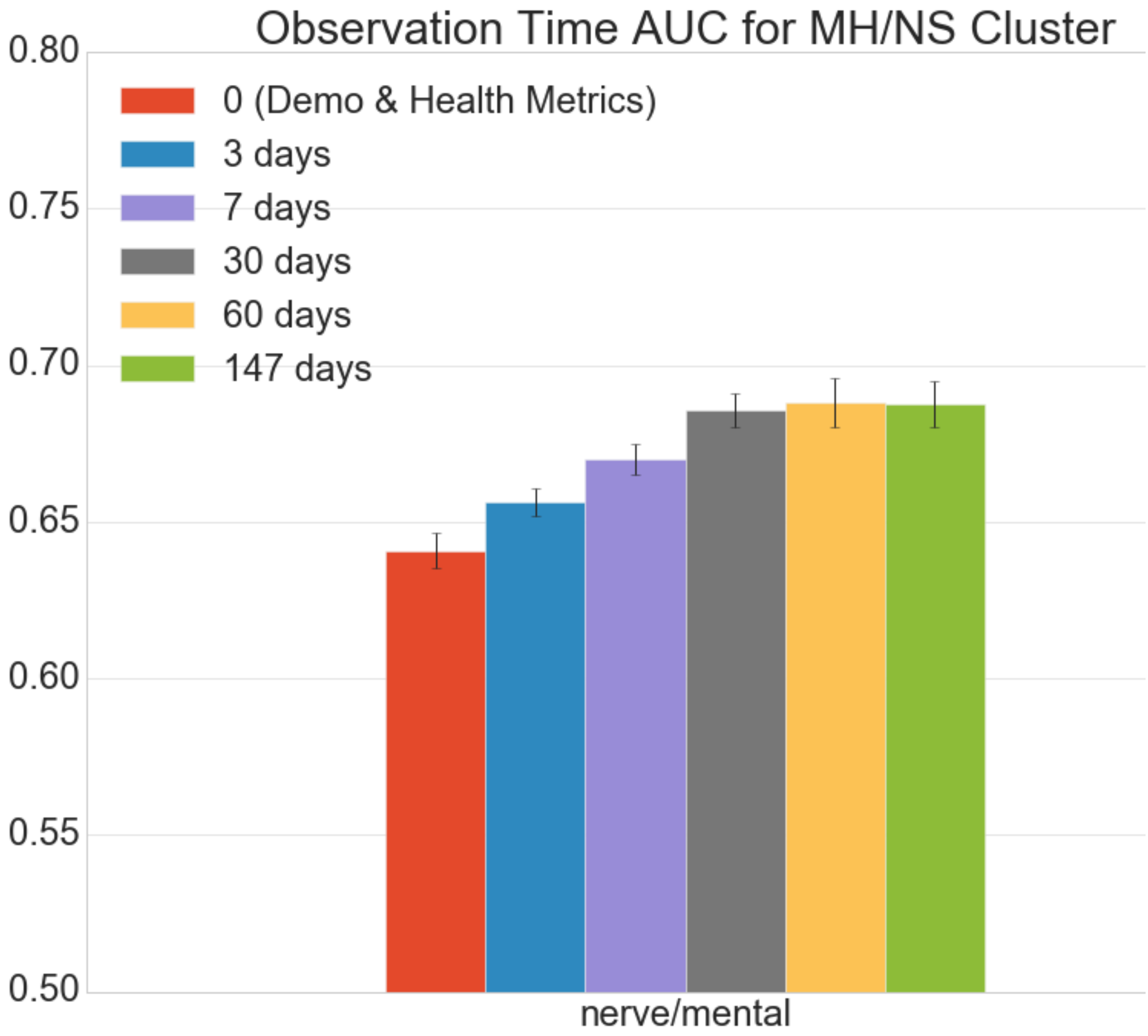

You may not need lots of data

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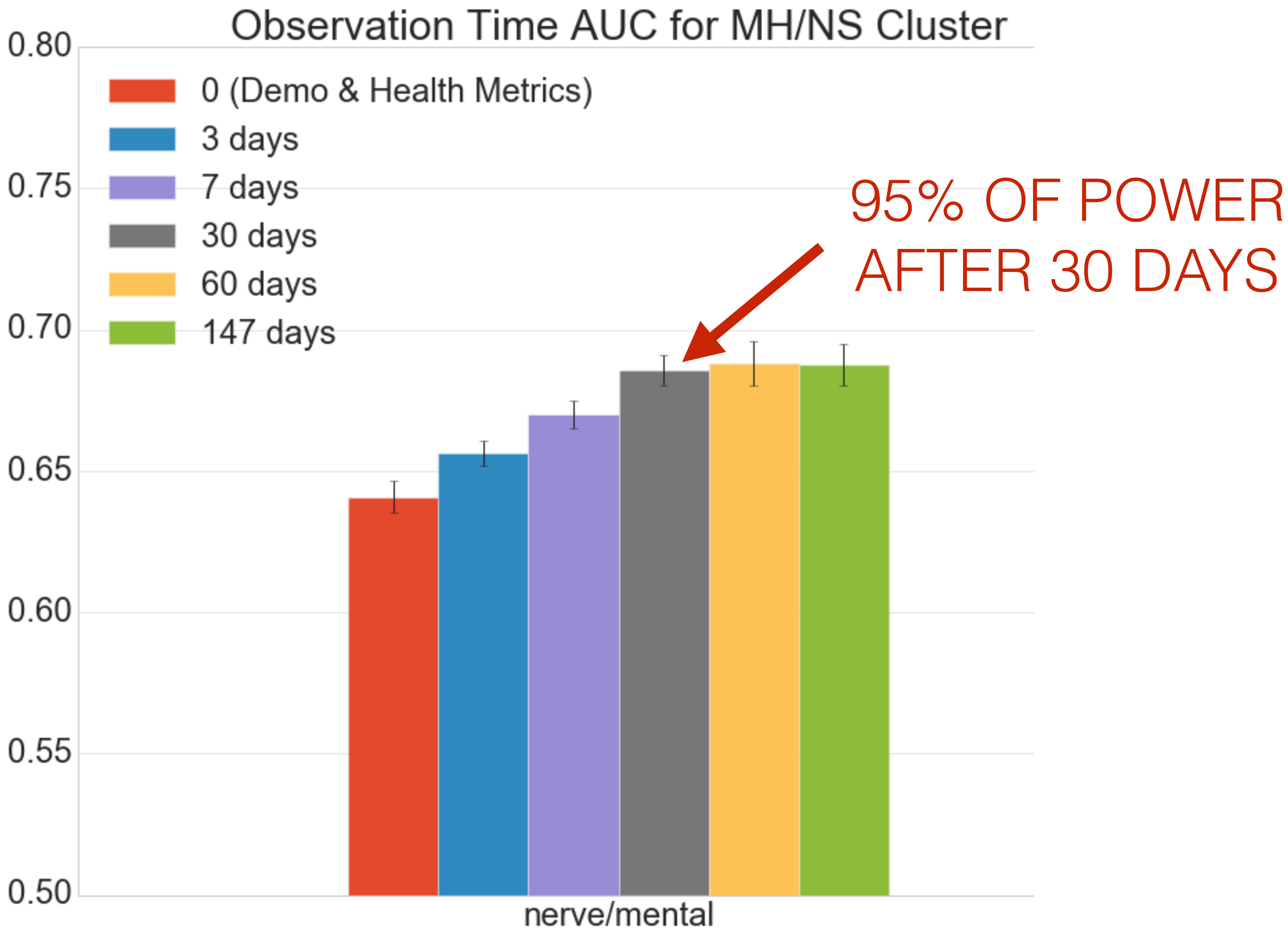
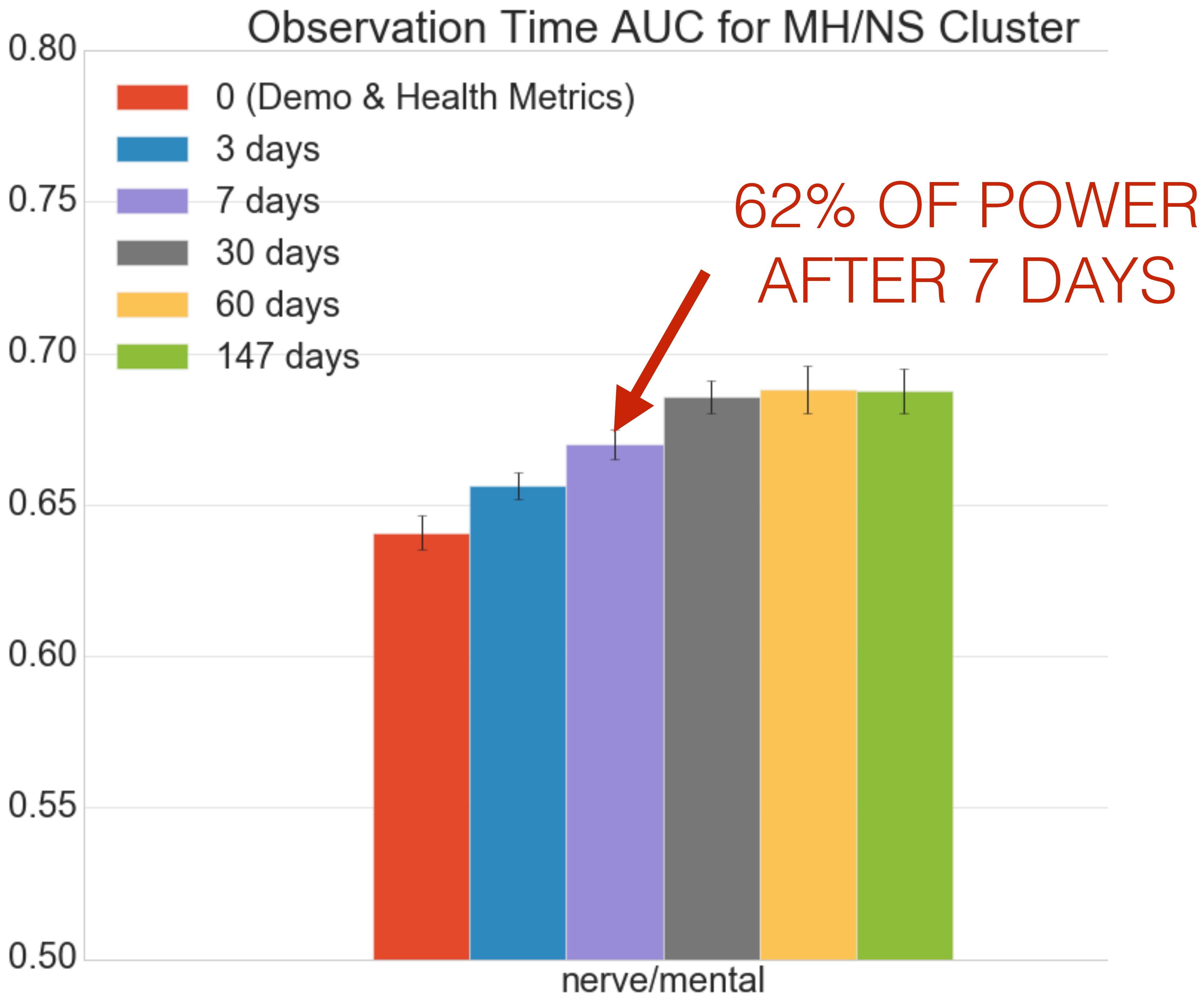


95% OF POWER AFTER 30 DAYS

You may not need lots of data


Observation Time AUC for MH/NS Cluster

62% OF POWER AFTER 7 DAYS

You may not need lots of data

Published 40+ Papers

in Medical Journals and Conferences

KDD

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Better Health Through Behavior Change

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