

My Brother Ed: Mental illness was not his choice

Andrew T. Campbell, Dartmouth College
ACM UbiComp Workshop on Mental Health and Wellbeing, Heidelberg, September 5, 2016



ca·ve·at

/'kavē ,at, 'kävē ,ät/

noun

a warning or proviso of specific stipulations, conditions, or limitations.

synonyms: [warning](#), [caution](#), [admonition](#); [More](#)

- **LAW**

a notice, especially in a probate, that certain actions may not be taken without informing the person who gave the notice.



Translations, word origin, and more definitions

Feedback

what is mental illness?

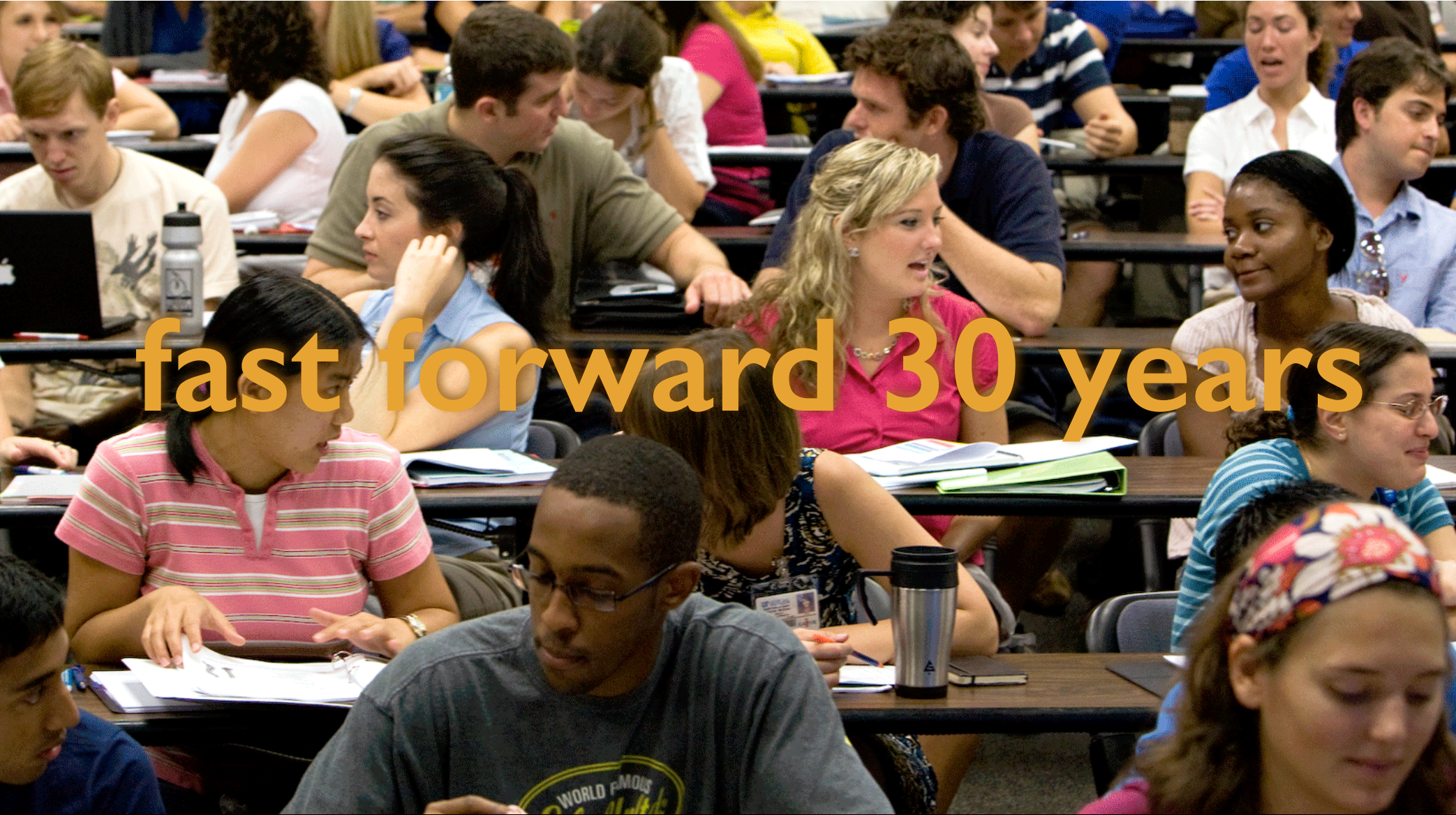












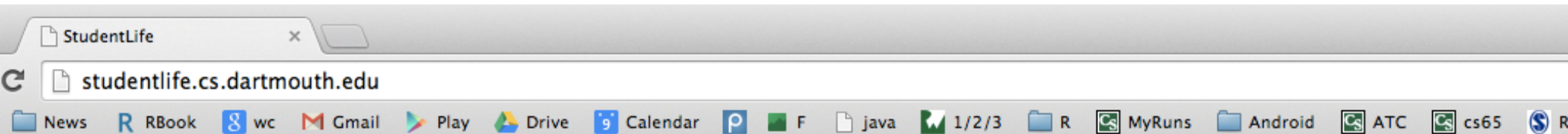
fast forward 30 years

A winter scene at Dartmouth College. The ground is covered in snow, and trees are bare. A student with a backpack is walking in the foreground. In the background, there is a large building with a green dome and a steeple. The sky is overcast.

11% of Dartmouth students were diagnosed with depression in 2014.

12% reported depression has having an impact on academic performance

28% have seen a mental health counselor in 2014

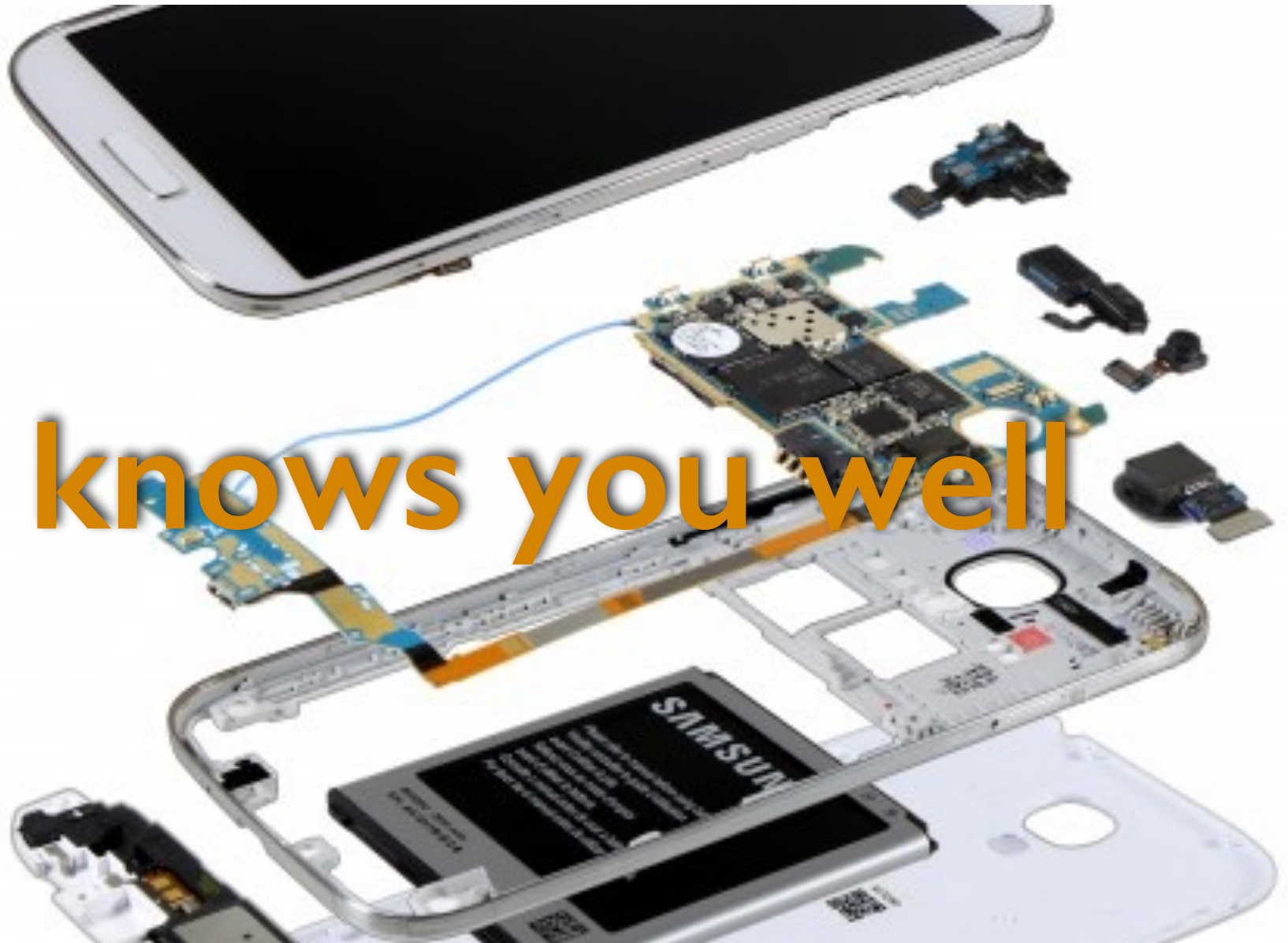


studentlife.cs.dartmouth.edu

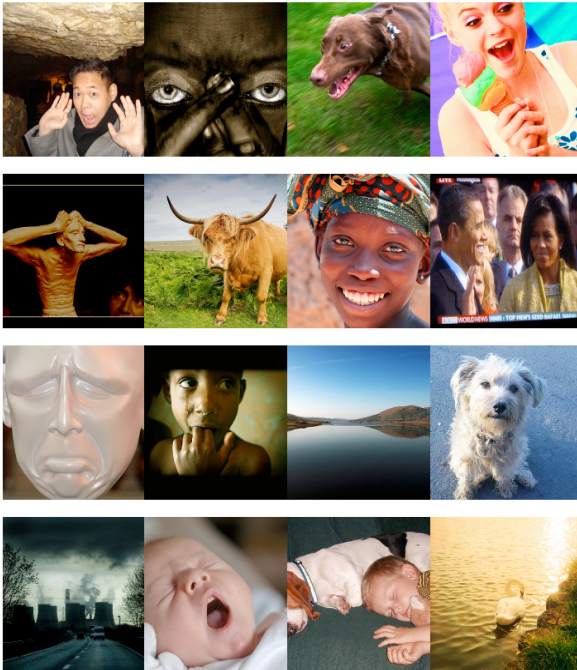
StudentLife

StudentLife is the first study that uses passive and automatic sensing data from the phones of a class of 48 Dartmouth students over a one-year term to assess their mental health (e.g., depression, loneliness, stress), academic performance (grades across all terms and cumulative GPA) and behavioral trends (e.g., how stress, sleep, visits to the gym, etc. change in response to college life).

it knows you well



Touch how you feel right now.



Stress

Right now, I am...

A little stressed

- A little stressed
- Definitely stressed
- Stressed out
- Feeling good
- Feeling great

Save Response

Sleep

How many hours did you sleep last night?

<3

How would rate your overall sleep last night?

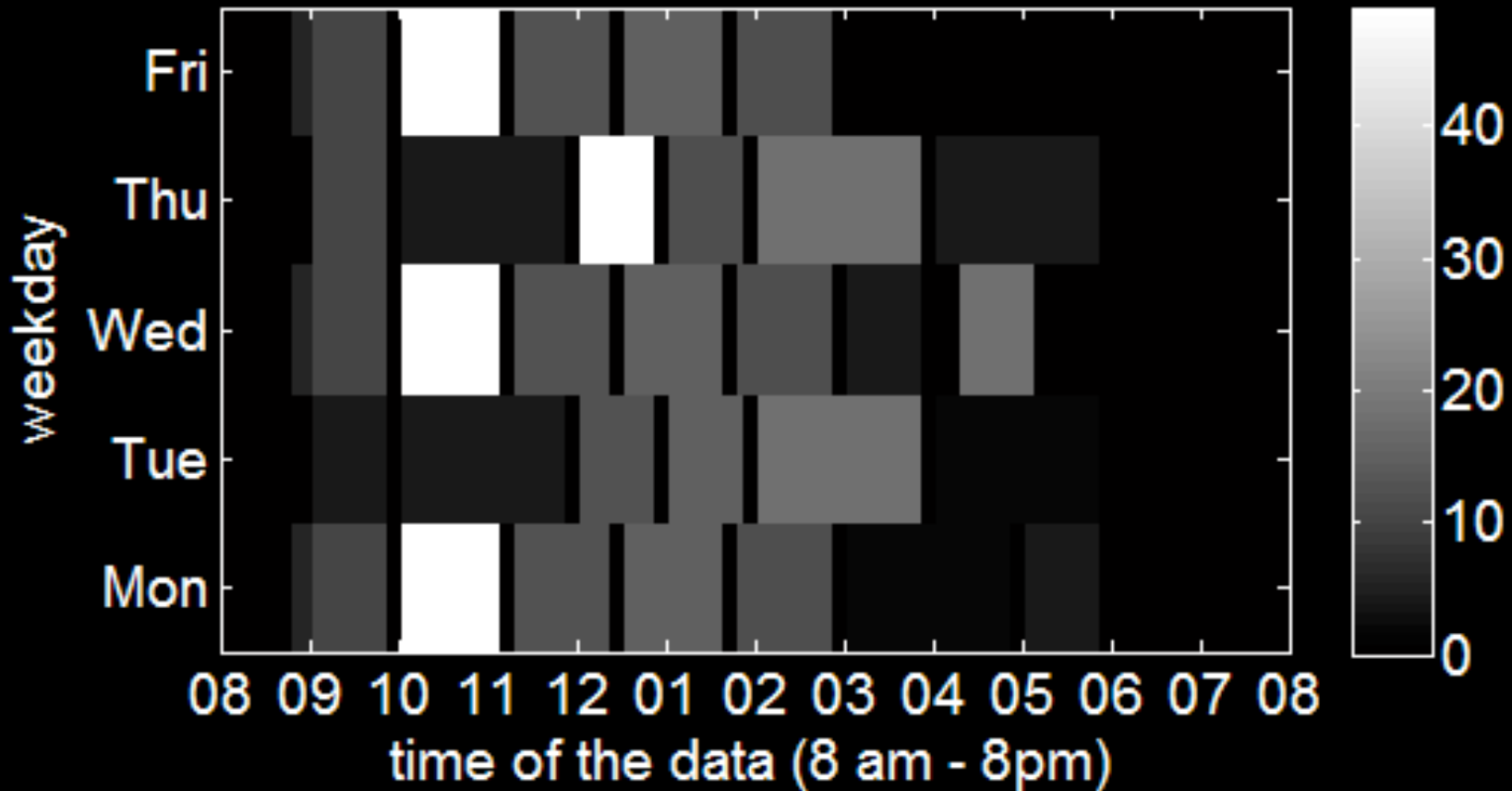
Very good

How often did you have trouble staying awake yesterday while in class, eating meals or engaging in social activity?

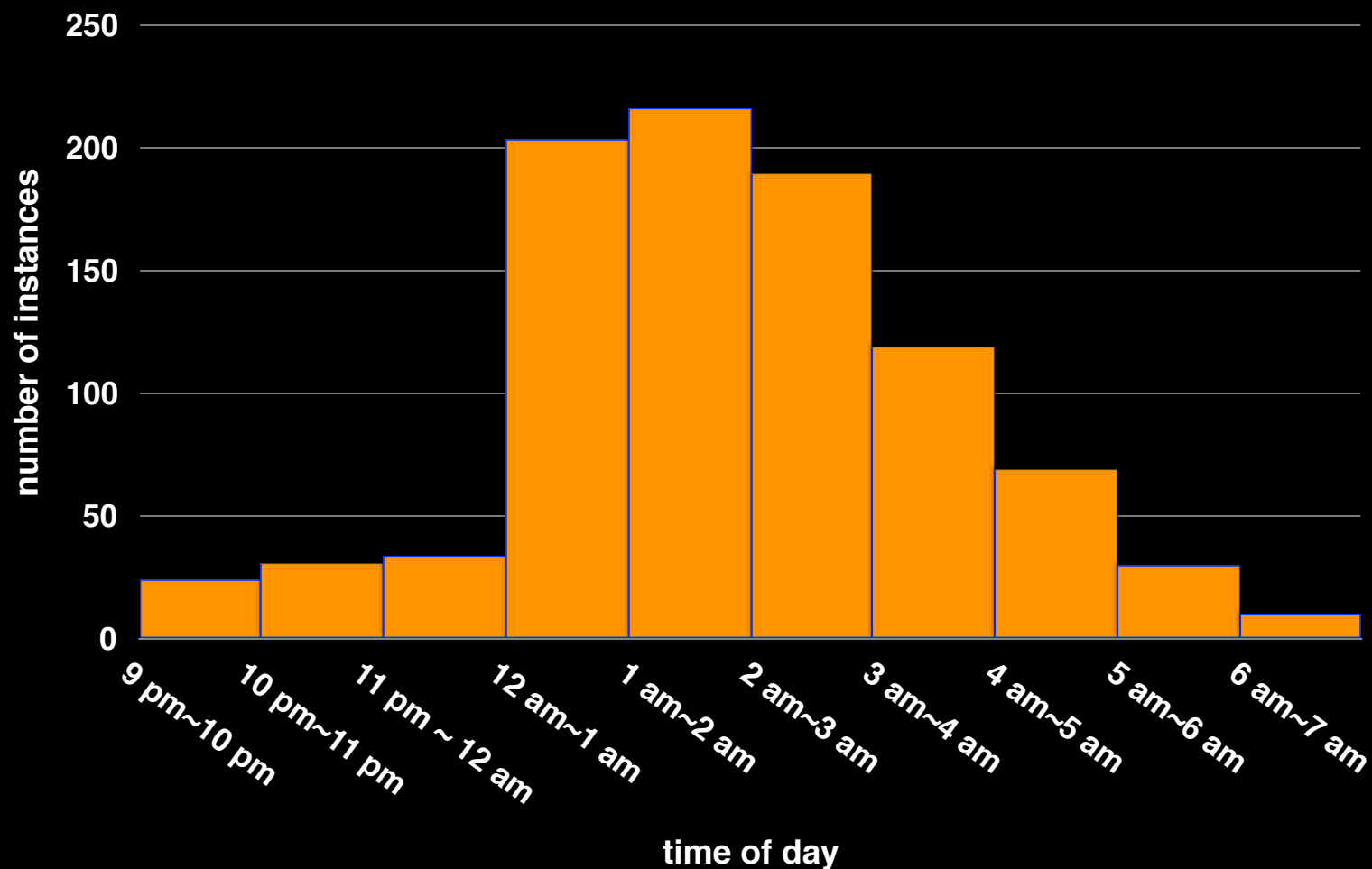
None

Save Response

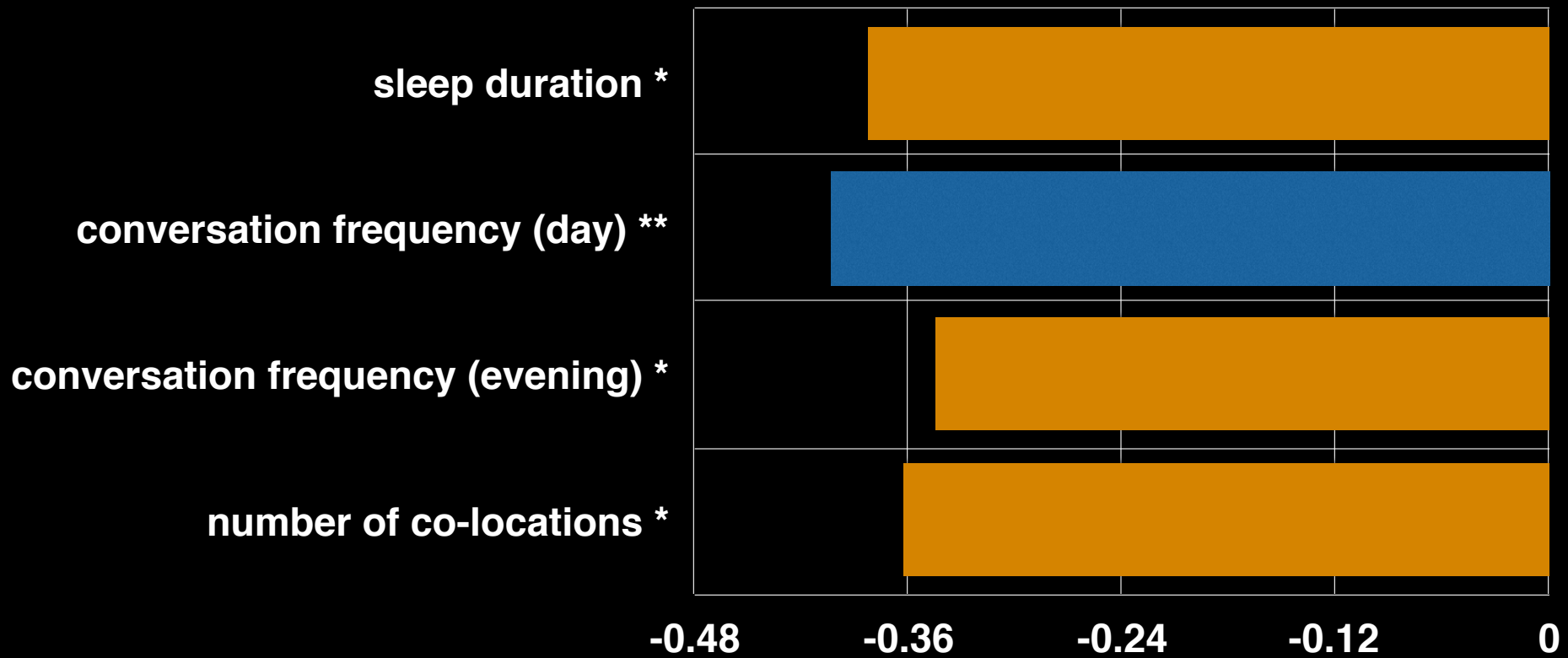
attendance rates



sleep



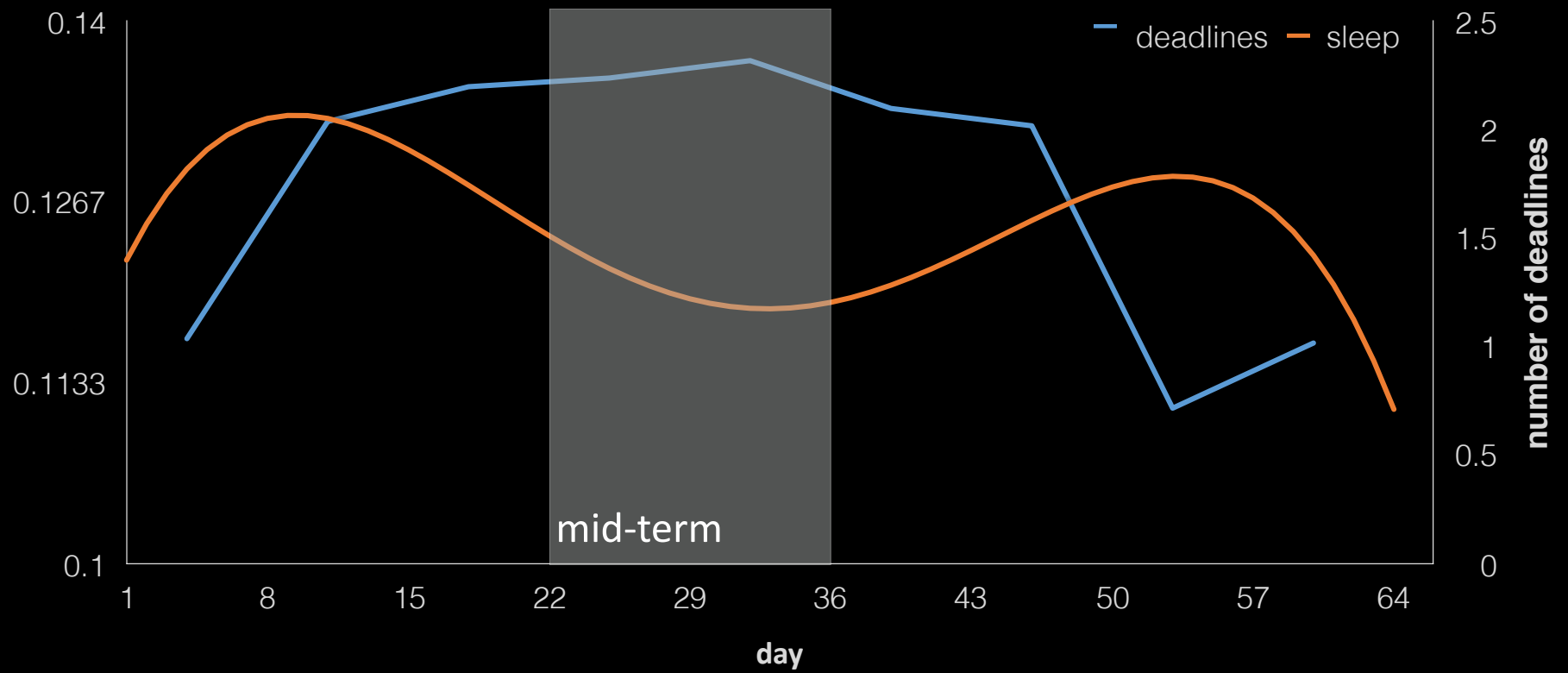
depression



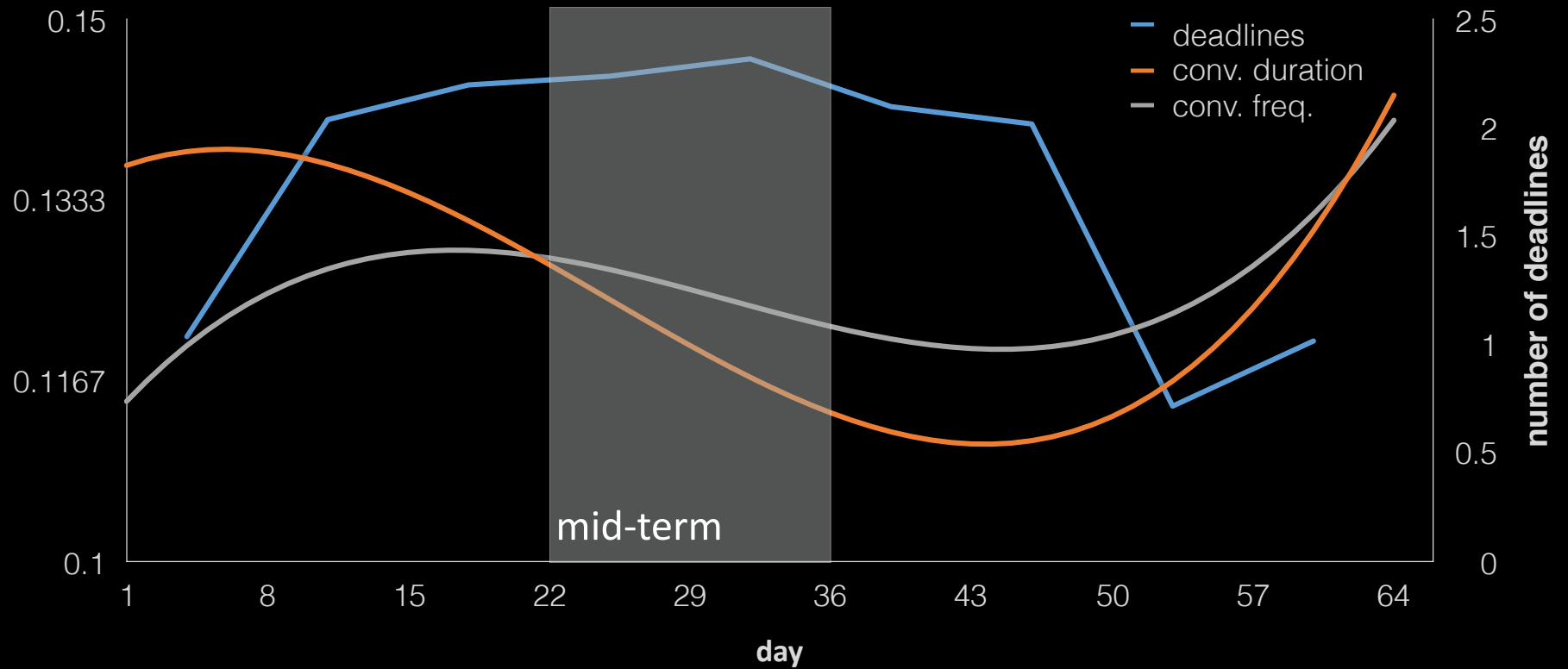
* $p \leq 0.05$, ** $p \leq 0.01$

R value

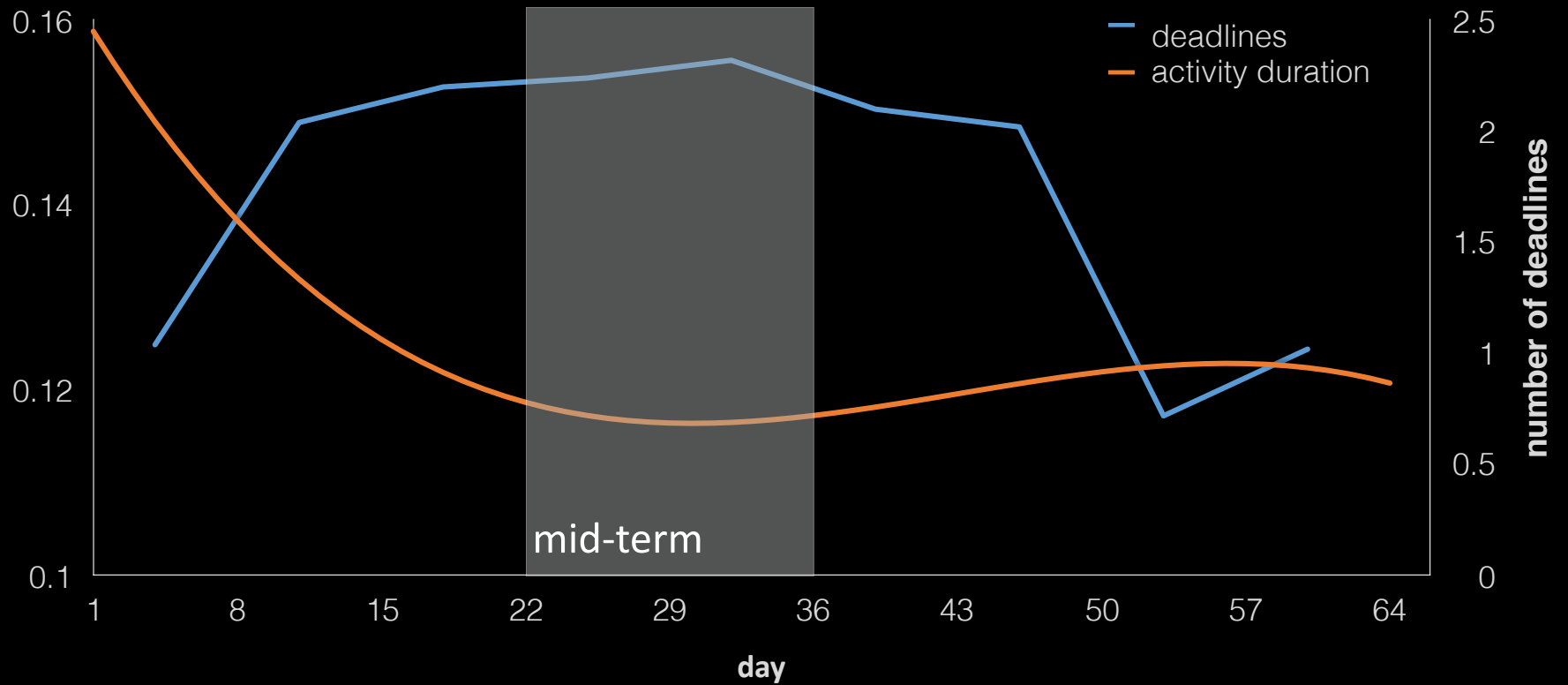
sleep



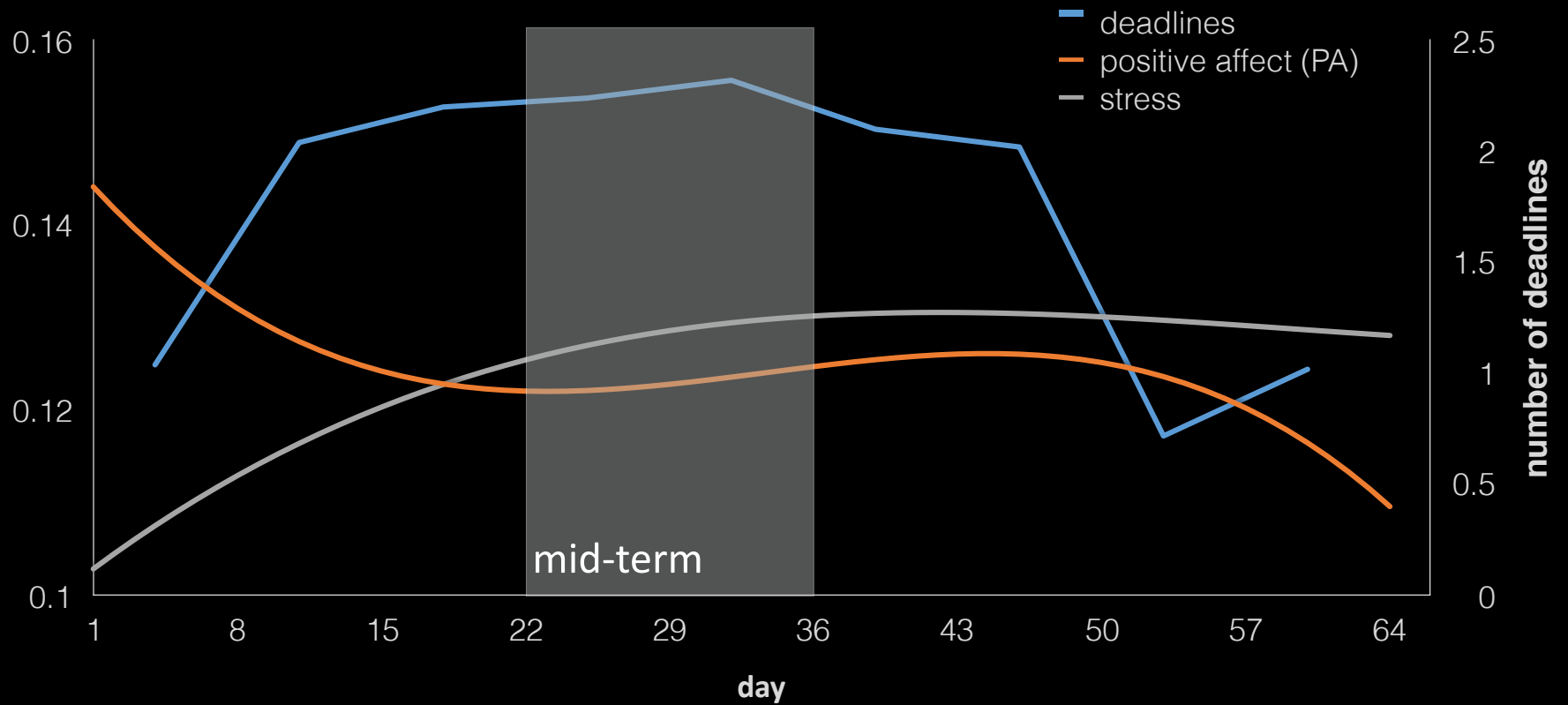
face-to-face conversation



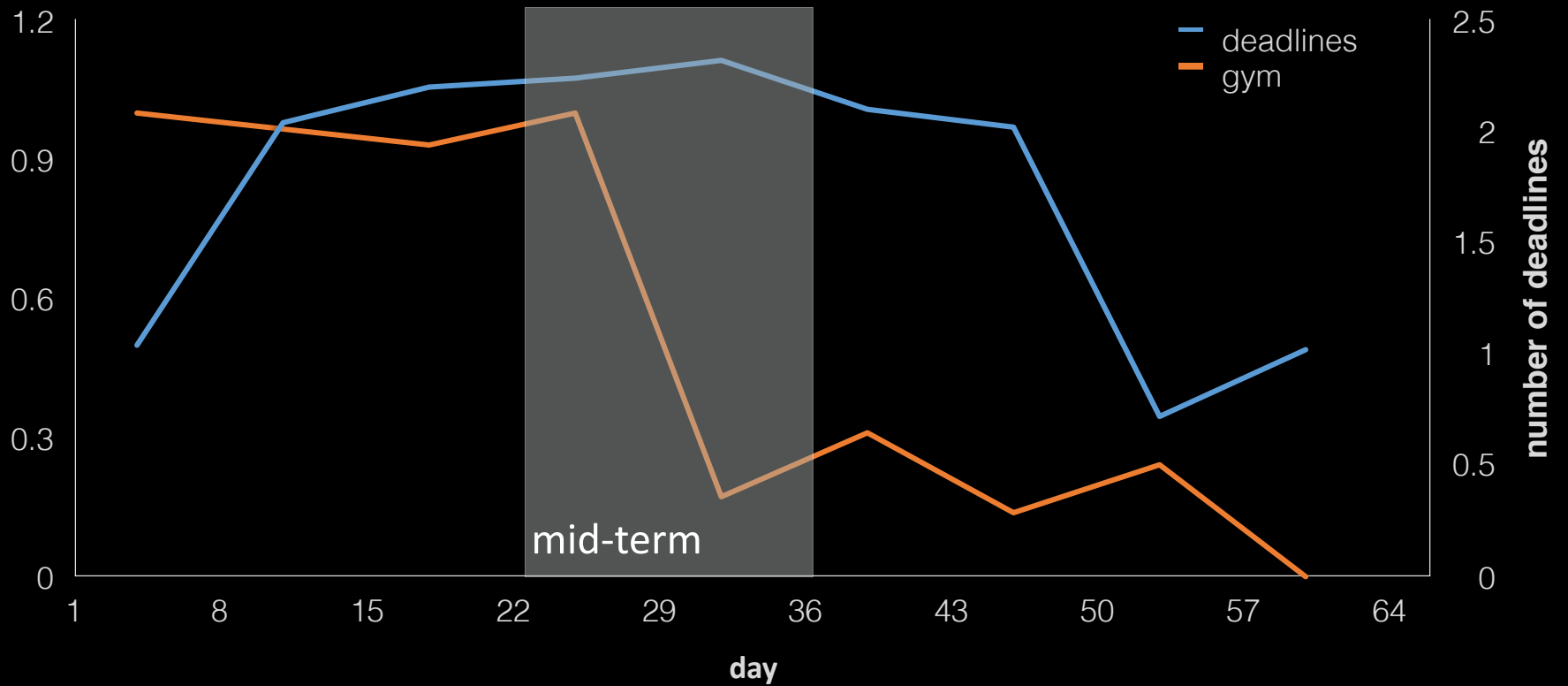
activity duration



stress and affect



gym visits

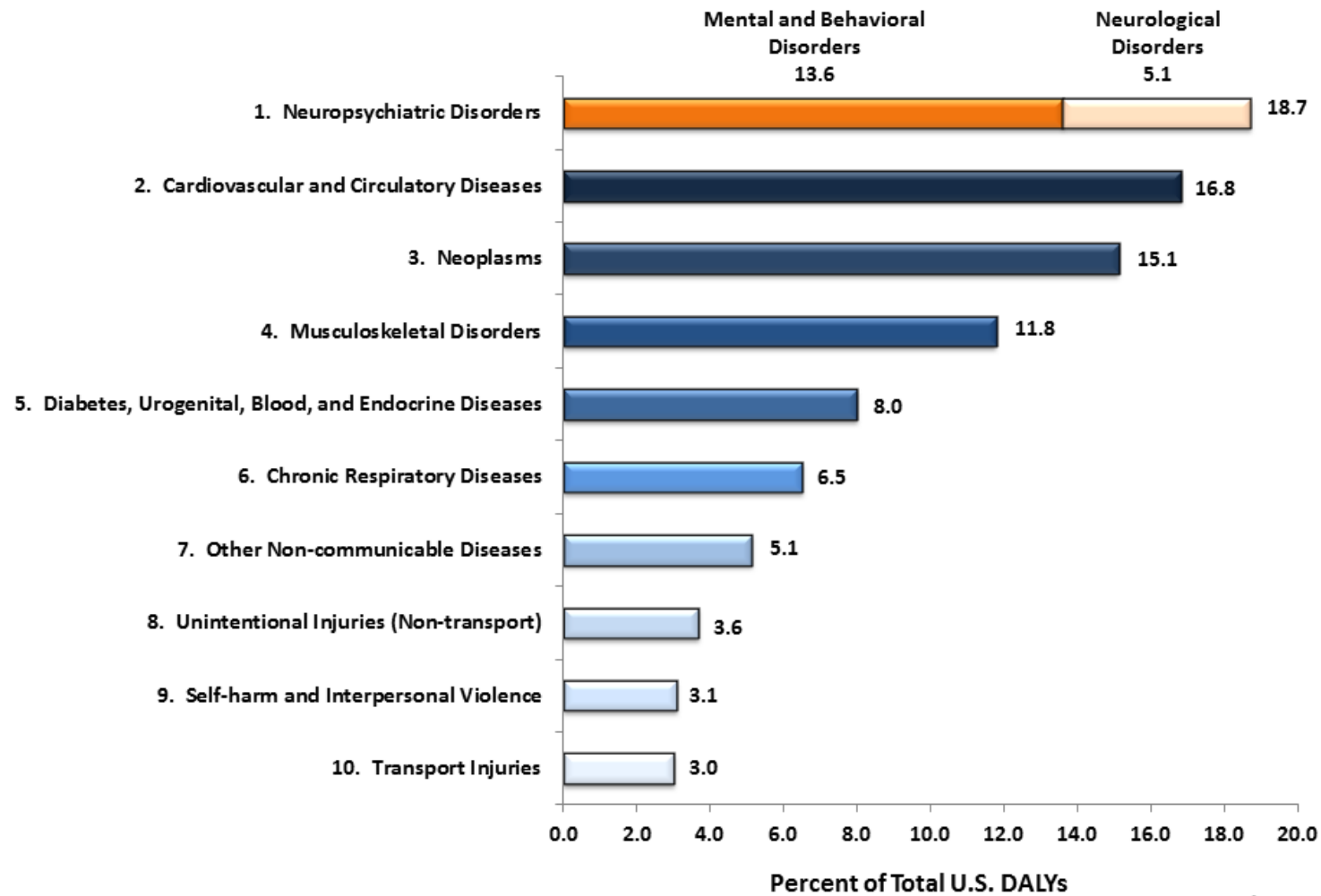






the silent tsunami

Top 10 Leading Disease/Disorder Categories Contributing to U.S. DALYs (2010)

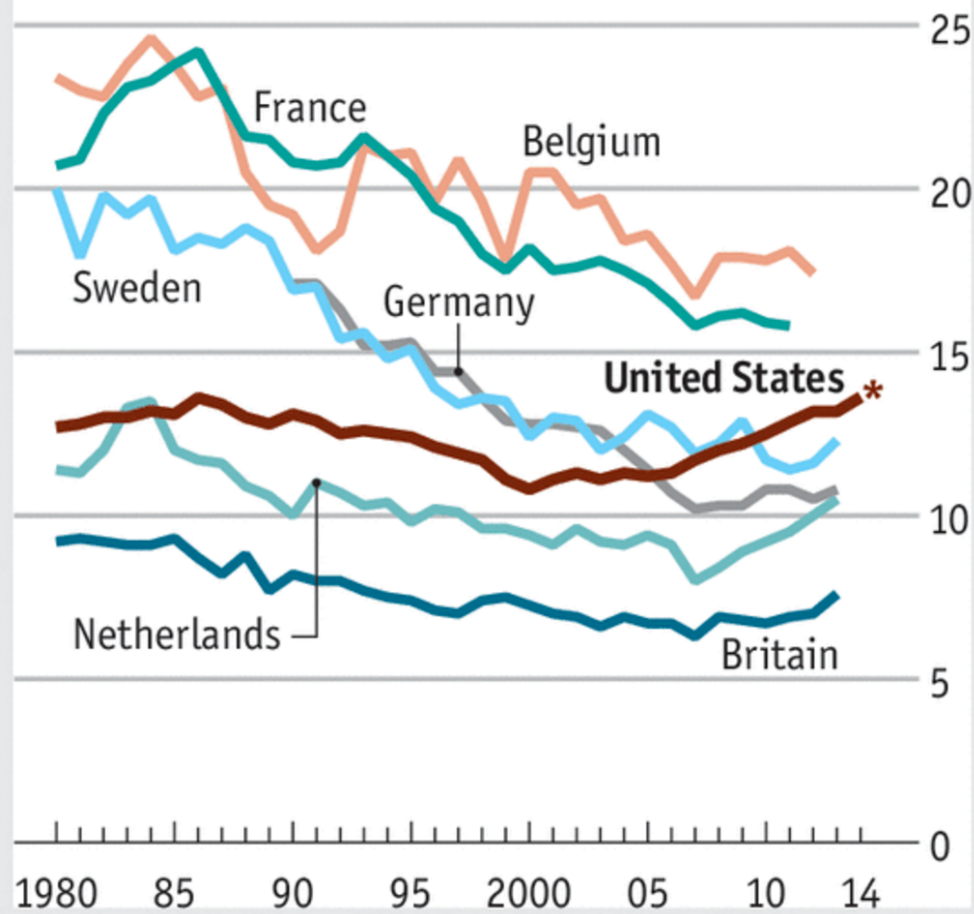






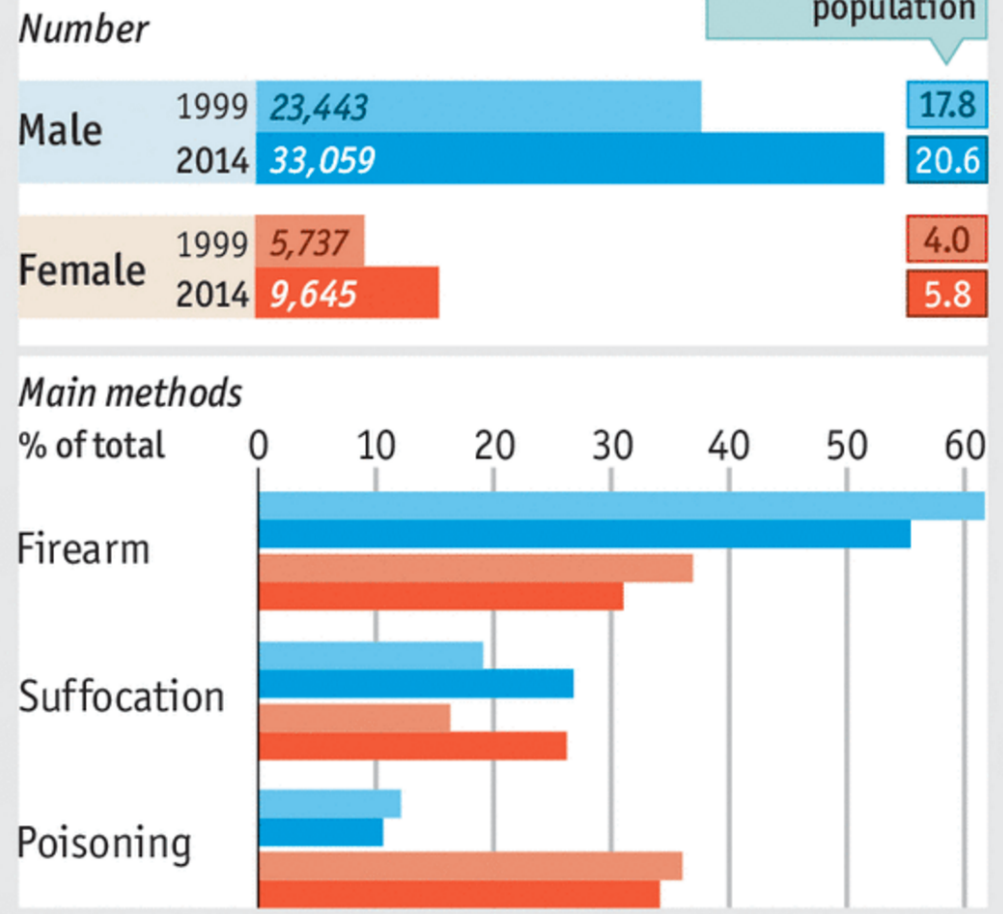
A tragic trend

Suicide rate per 100,000 population



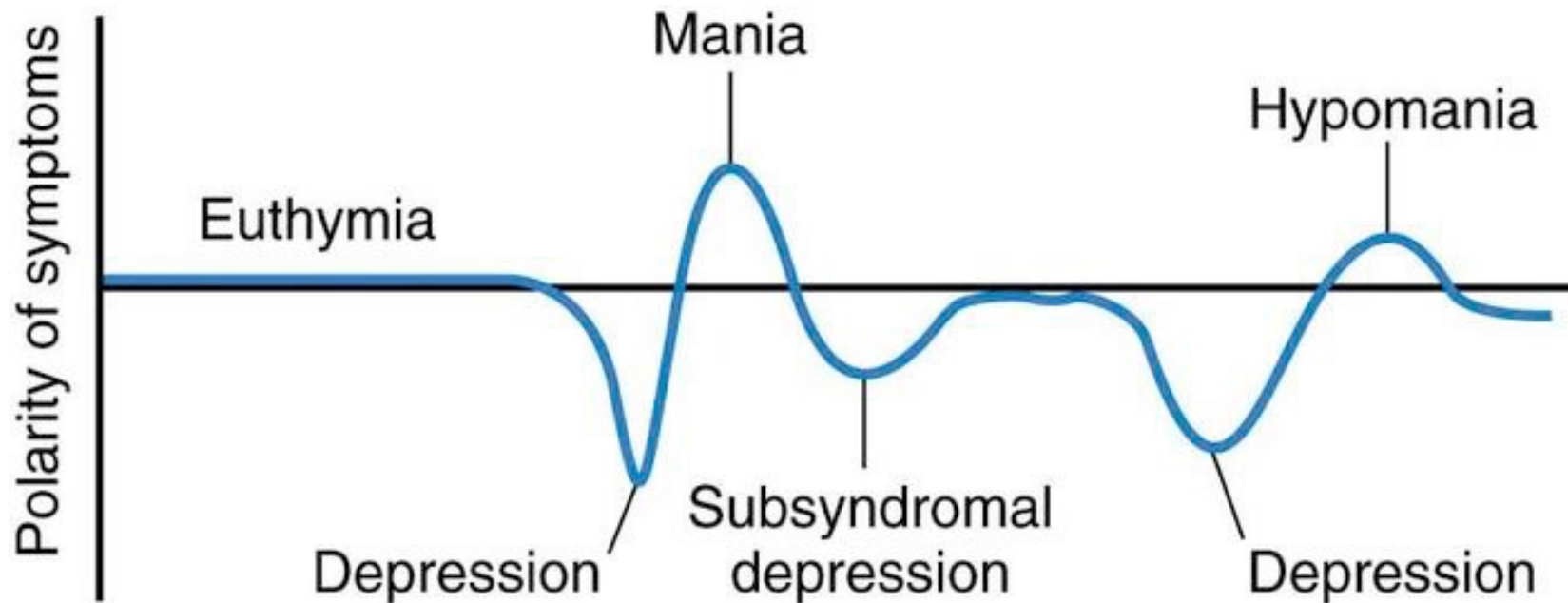
Sources: OECD; US Centres for Disease Control and Prevention

Suicides, United States



*2011-14 *Economist* estimates using CDC data





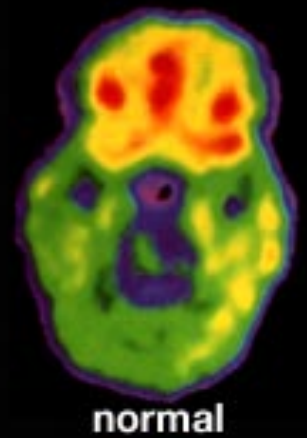
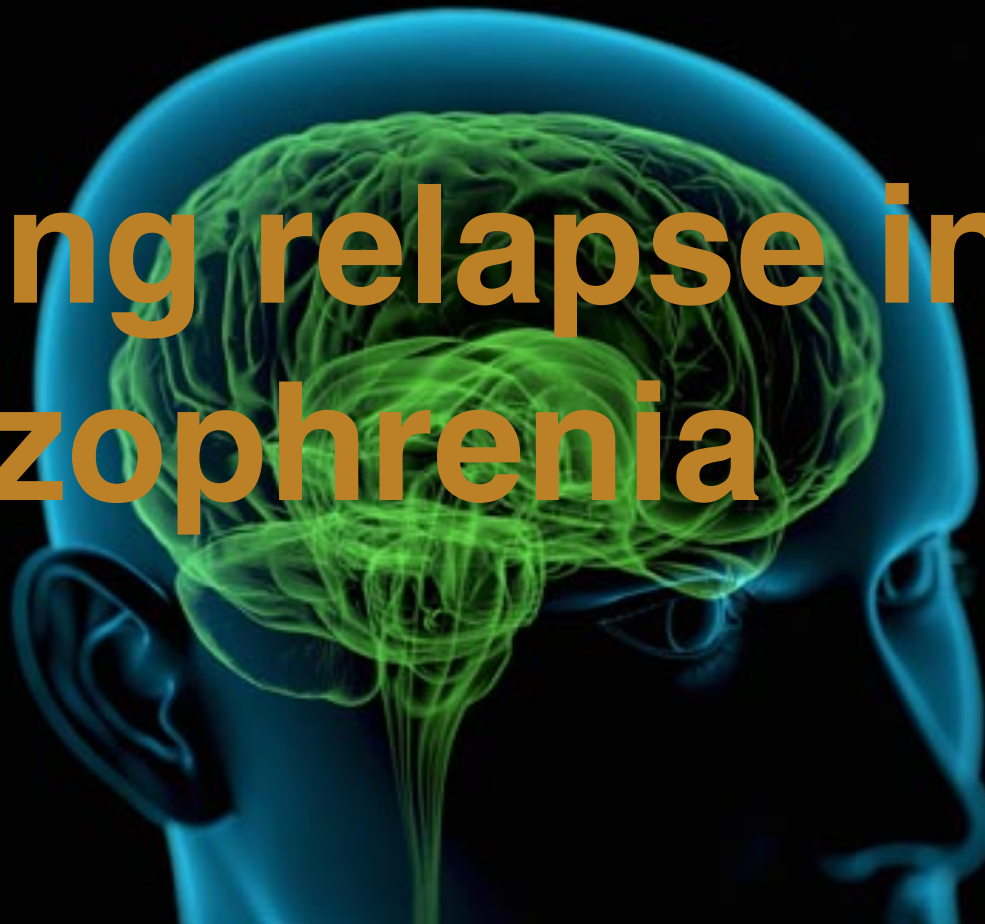
he always went off his meds

electroconvulsive therapy (ECT), aka electroshock therapy

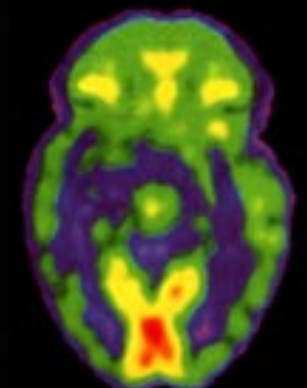


Elektrosjokkapparat
produsert av Siemens.
Brukt ved Eg asyl
i 1960- og 70-årene.

Predicting relapse in schizophrenia

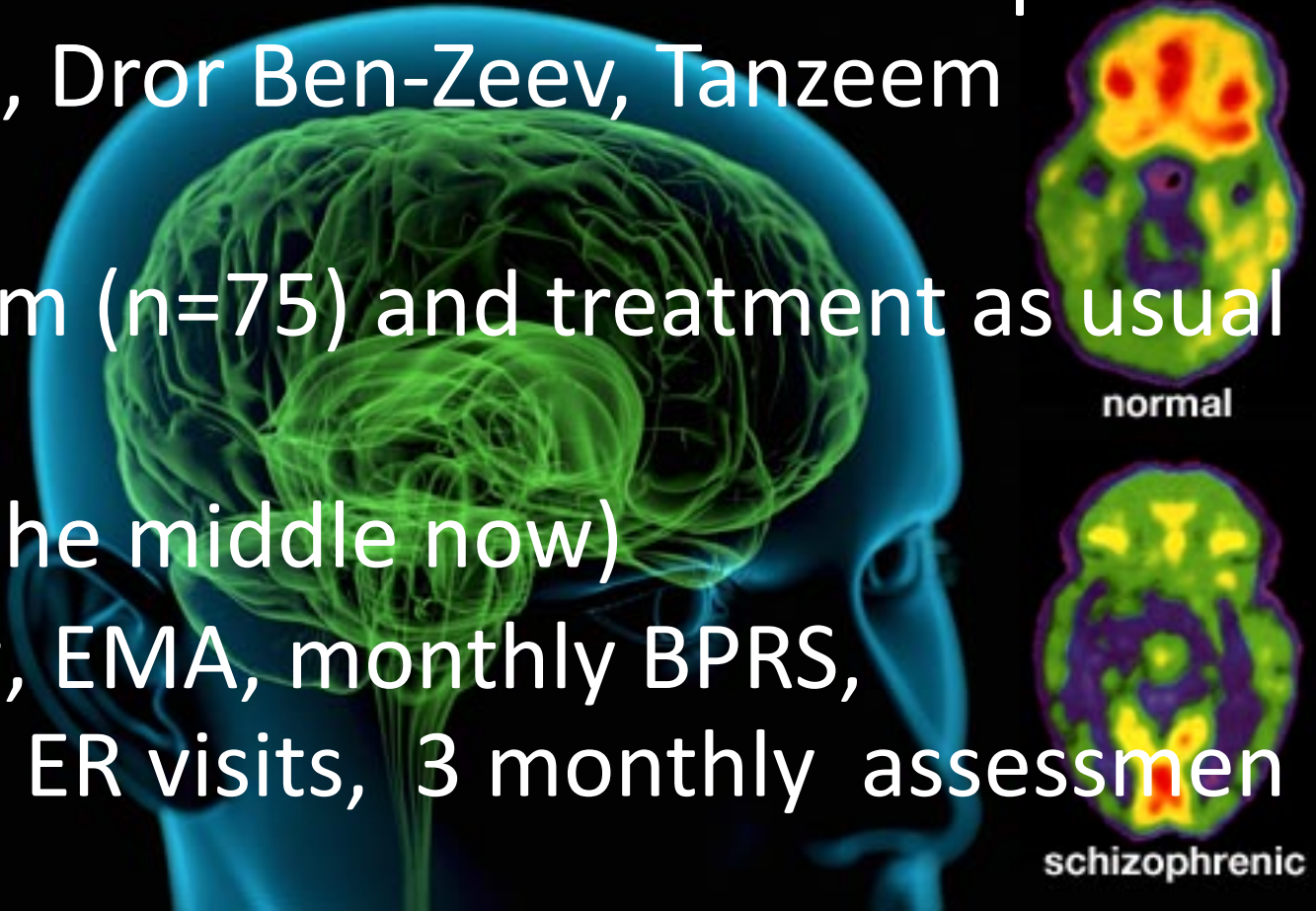


normal



schizophrenic

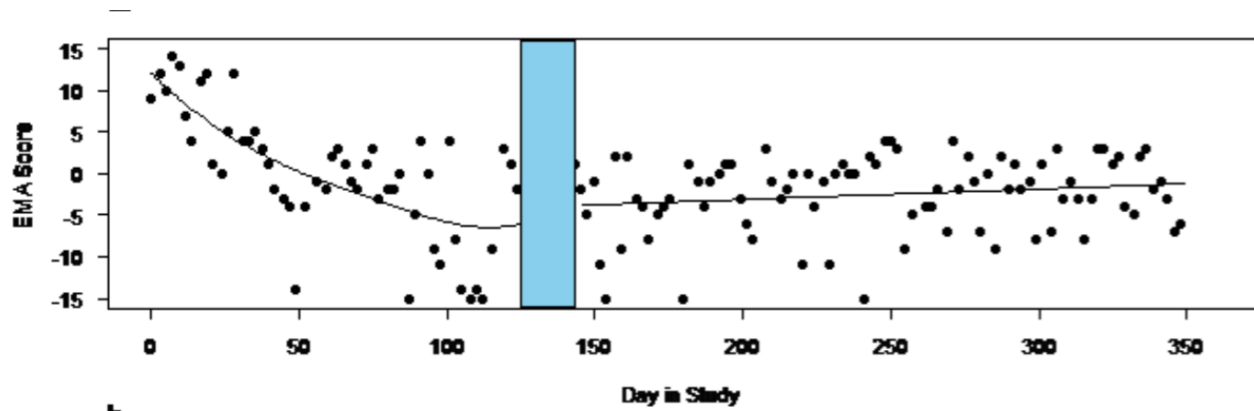
- Randomize Control Trial at Zucker Hill Hospital with John Kane, Dror Ben-Zeev, Tanzeem Choudhry
- Smartphone arm (n=75) and treatment as usual arm (n=75).
- 12 months (in the middle now)
- Passive sensing, EMA, monthly BPRS, hospitalization, ER visits, 3 monthly assessments



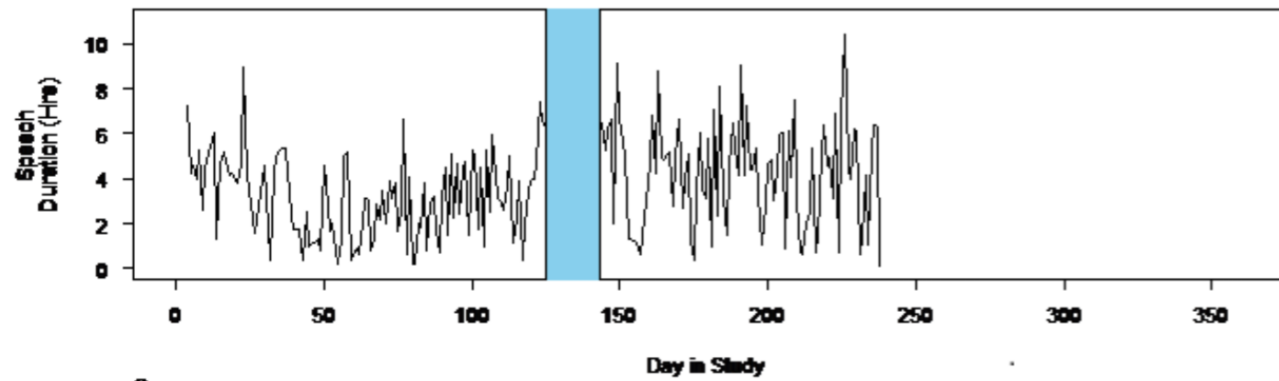
CALM Have you been feeling CALM?
SOCIAL Have you been SOCIAL?
VOICES Have you been bothered by VOICES?
SEEING THINGS Have you been SEEING THINGS other people can't see?
STRESSED Have you been feeling STRESSED?
HARM Have you been worried about people trying to HARM you?
SLEEPING Have you been SLEEPING well?
THINK Have you been able to THINK clearly?
DEPRESSED Have you been DEPRESSED?
HOPEFUL Have you been HOPEFUL about the future?



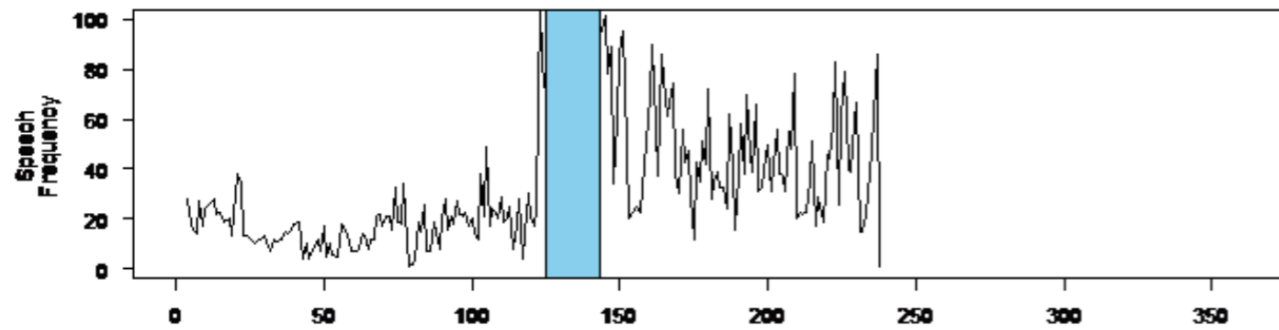
is there a relapse signal?

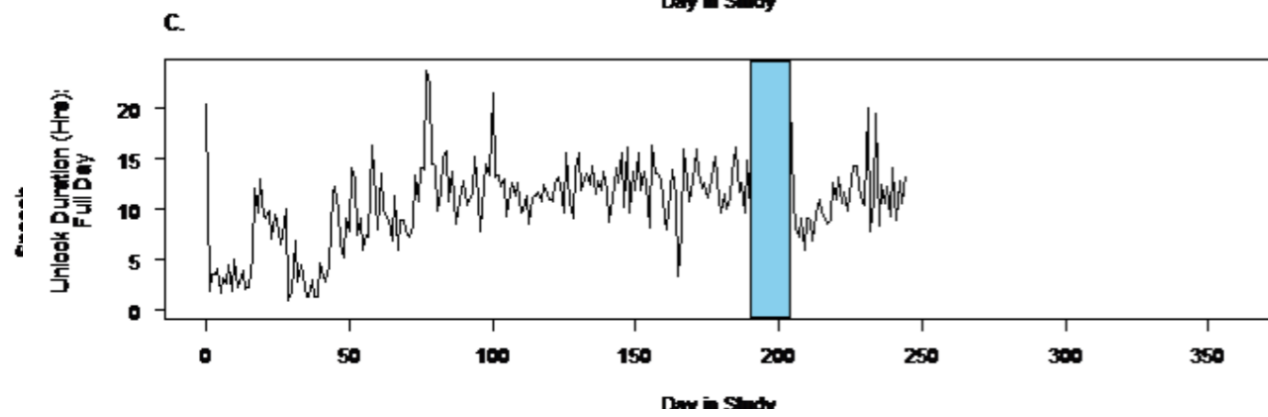
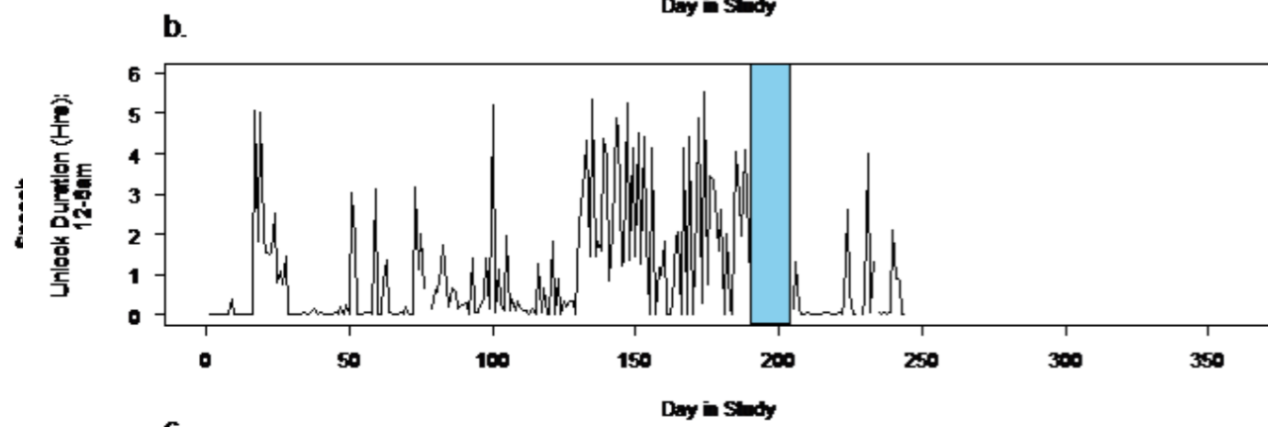
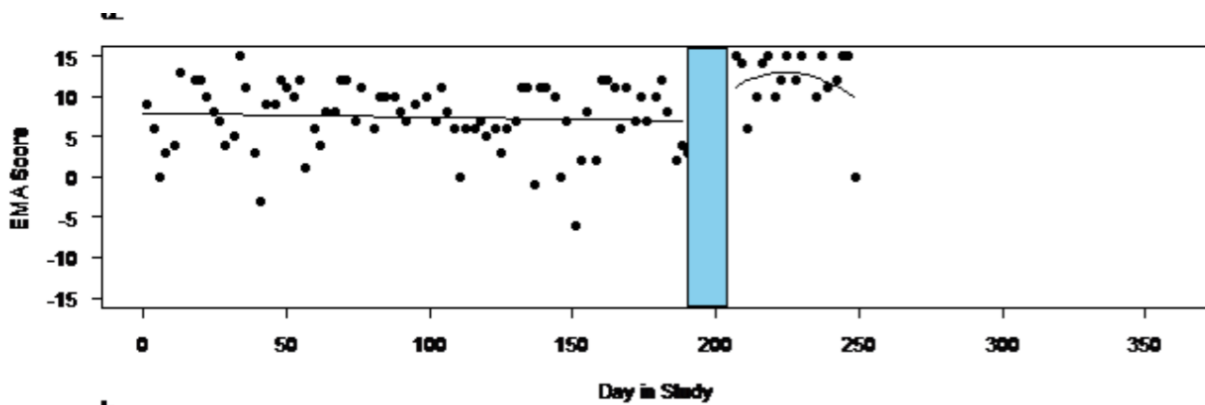


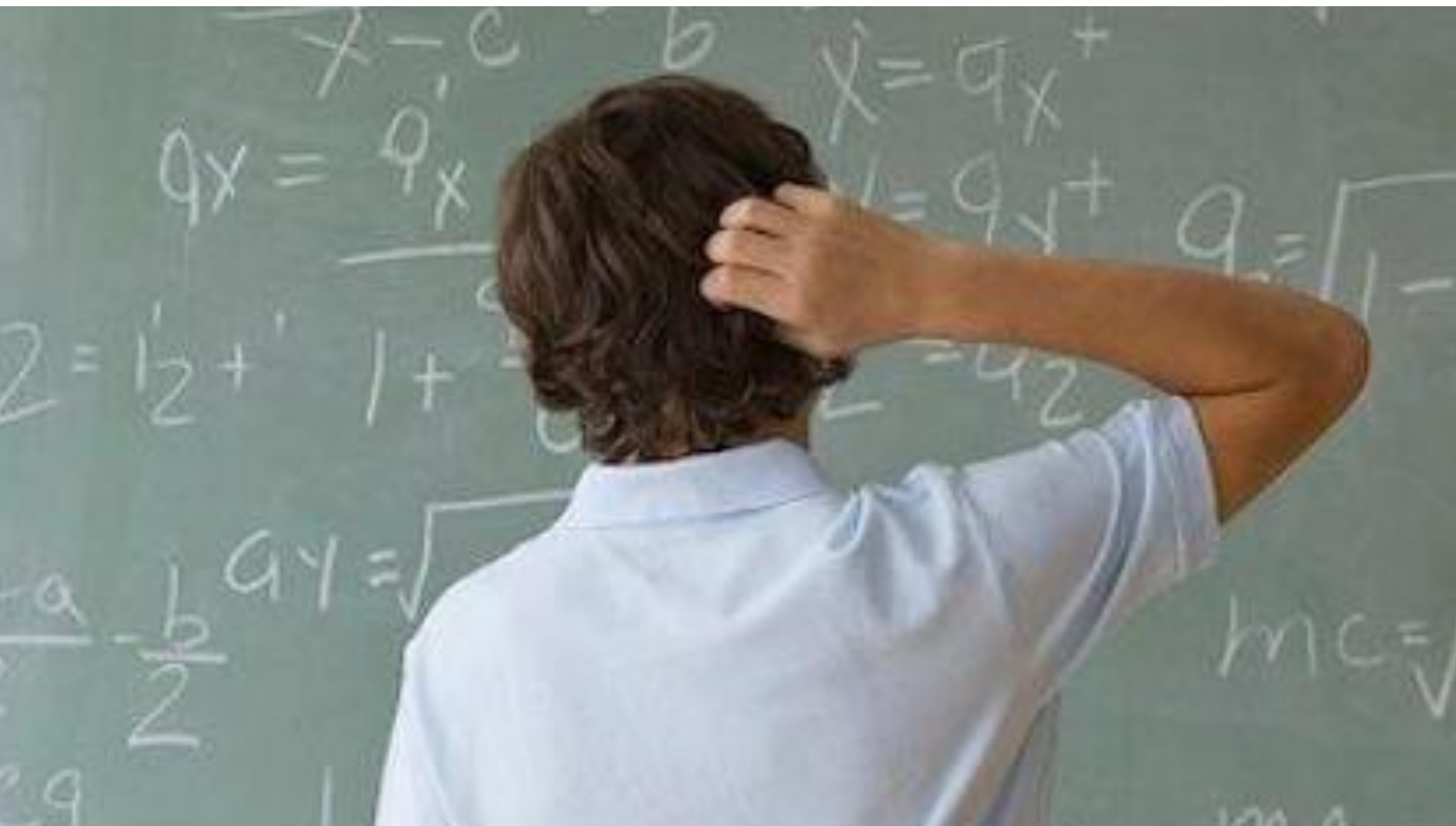
b.



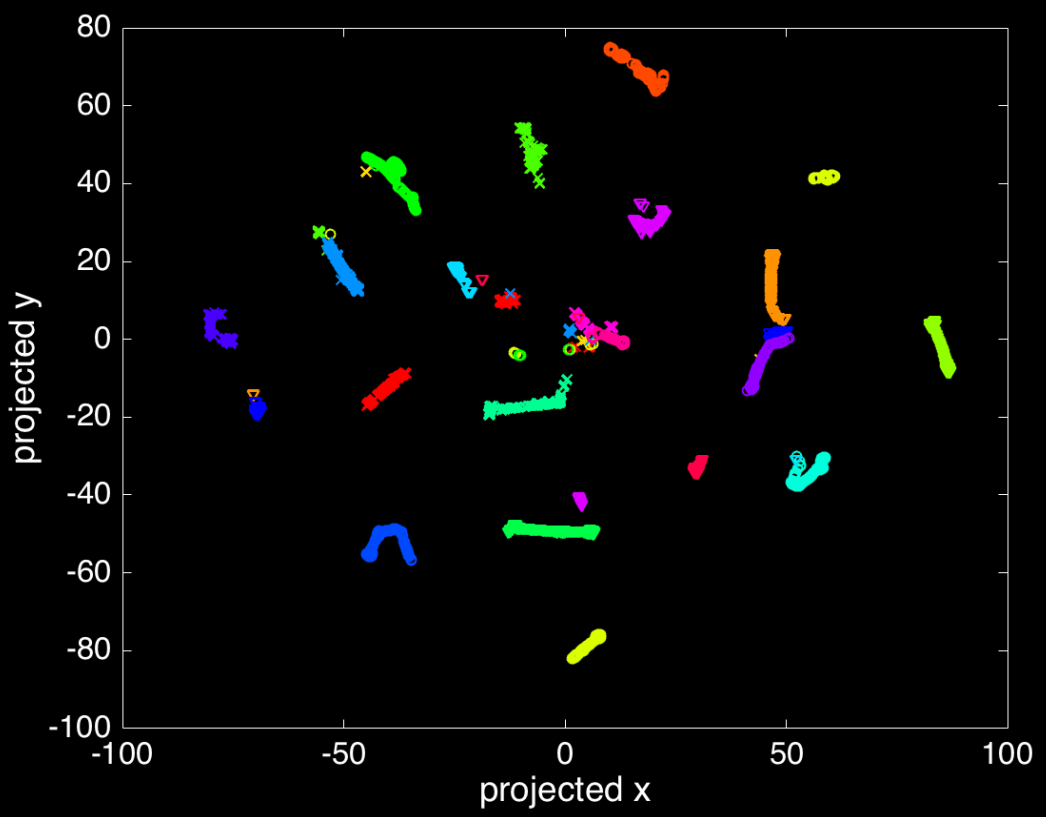
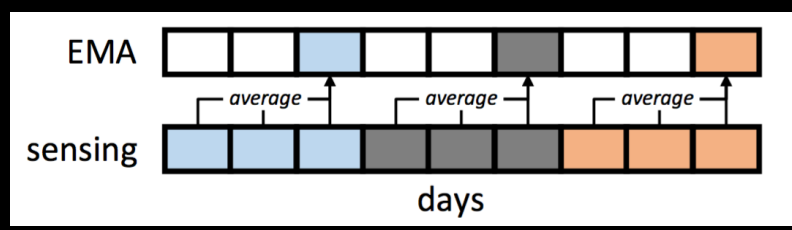
c.



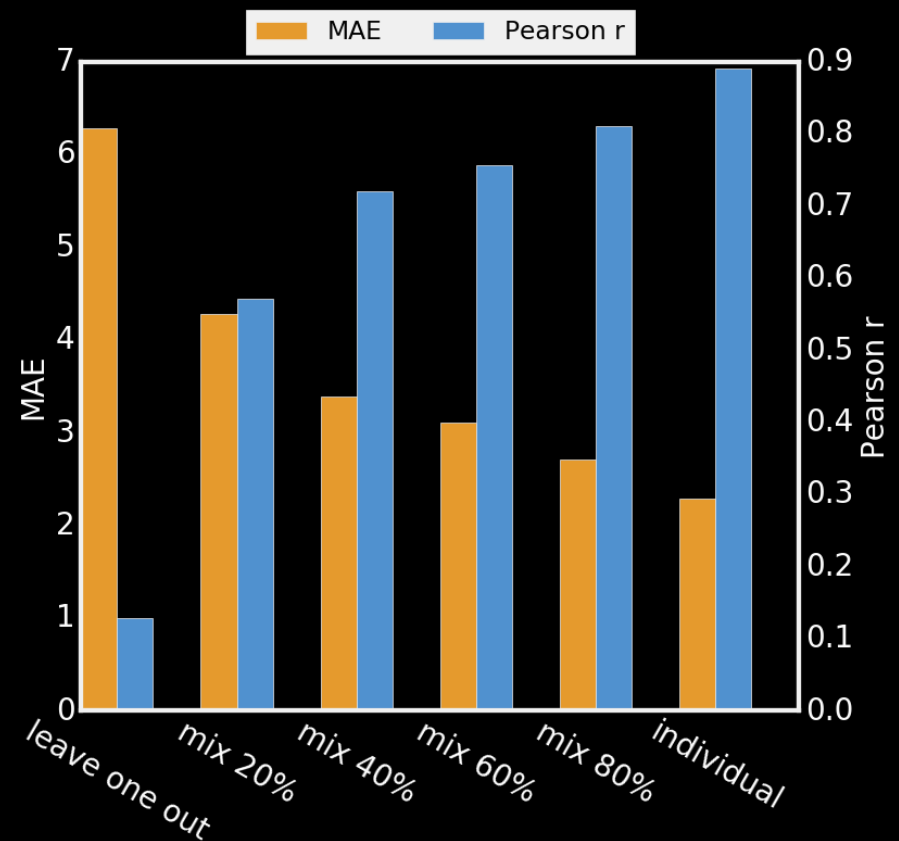




predicting health dimensions



Feature visualization



Sum prediction

BRIEF PSYCHIATRIC RATING SCALE (BPRS)

Patient Name _____

Today's Date _____

Please enter the score for the term that best describes the patient's condition.

0 = Not assessed, 1 = Not present, 2 = Very mild, 3 = Mild, 4 = Moderate, 5 = Moderately severe, 6 = Severe, 7 = Extremely severe

Score

1. SOMATIC CONCERN

Preoccupation with physical health, fear of physical illness, hypochondriasis.

2. ANXIETY

Worry, fear, over-concern for present or future, uneasiness.

3. EMOTIONAL WITHDRAWAL

Lack of spontaneous interaction, isolation deficiency in relating to others.

4. CONCEPTUAL DISORGANIZATION

Thought processes confused, disconnected, disorganized, disrupted.

5. GUILT FEELINGS

Self-blame, shame, remorse for past behavior.

6. TENSION

COMPOSE

Inbox (31,374)

Starred

Chats

Sent Mail

Drafts (481)

Spam (1,258)

Trash

Green Card

GreenLite

Notes

More

Andrew

Hane, Mark Matth

Miles Campbell

Miles Campbell

Deepak Ganesan

Eureka Weekly BPRS Report 2016-09-07 Inbox x

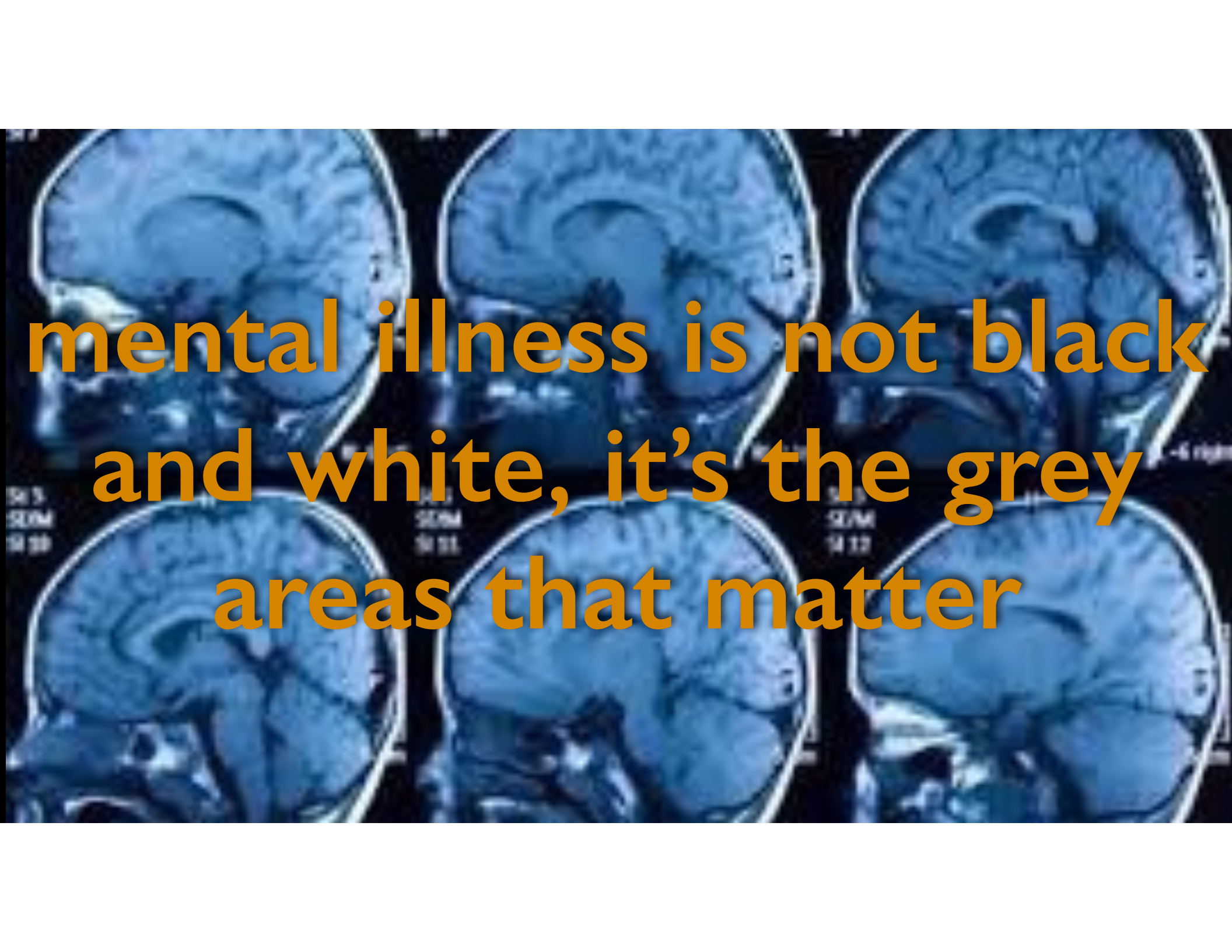
Eureka.Weekly.BPRS.Report@cs.dartmouth.edu Sep 7 (1 day ago)

to Raymond.J.Walk., EGloegler, wt262, Mhauser, tanzeem.choudh., sma249, msa242, Emily.A.Scherer, rui.wang.gr, weichen.wang.gr, varun, rachel.m.briar

Prediction Report for 2016-9-7

Model evaluation: MAE=2.30798489712, r=0.385530592478, p=1.98501272357e-06

User	Predicted BPRS	Change Since Last Predicted BPRS	Change Since Second to Last Predicted BPRS	Change Since Last BPRS	Last Predicted BPRS	Second to Last Predicted BPRS	Last BPRS	Last BPRS Date	Avg BPRS	Num of BPRS	Num of Relapse
u079_rct@eureka147	13.6539641466	0.222493081866	0.314497682435	0.706745518321	11.1689500326	10.3872105132	8.0	20160719	8.0	1	0
u086_rct@eureka131	11.679756919	0.153296658453	0.148953473689	0.459969614876	10.1272789038	10.1655612577	8.0	20160725	8.0	1	0
u056_rct@eureka083	12.3407620346	0.130754572377	0.150202079796	0.762966004945	10.9137405553	10.7292120675	7.0	20160727	7.333333333333	6	0
u083_rct@eureka139	9.21058072234	0.106887768844	-0.0216140478532	-1	8.32115141354	9.41405659202	-1	-1	-1	0	0
u059_rct@eureka100	9.84447309455	0.0453892888859	-0.107123387673	0.230559136819	9.41704033054	11.0255694445	8.0	20160504	8.0	3	0
u078_rct@eureka135	9.14926470675	0.0108577735996	0.103952199627	-1	9.05099109459	8.28773628952	-1	-1	-1	0	0
u051_rct@eureka095	8.81621603548	0.00789464736147	0.0102251715312	0.102027004435	8.74716028958	8.72698115621	8.0	20151204	8.0	1	0
u072_rct@eureka112	10.9803451141	0.004257917523	0.00185635938526	-1	10.9337899384	10.9599994164	-1	-1	-1	0	0



**mental illness is not black
and white, it's the grey
areas that matter**

Diagnostic Criteria for Major Depressive Disorder and Depressive Episodes

DSM-IV Criteria for Major Depressive Disorder (MDD)

- Depressed mood or a loss of interest or pleasure in daily activities for more than two weeks.
- Mood represents a change from the person's baseline.
- Impaired function: social, occupational, educational.
- Specific symptoms, at least 5 of these 9, present nearly every day:
 1. Depressed mood or irritable most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful).
 2. Decreased interest or pleasure in most activities, most of each day
 3. Significant weight change (5%) or change in appetite
 4. Change in sleep: Insomnia or hypersomnia
 5. Change in activity: Psychomotor agitation or retardation
 6. Fatigue or loss of energy
 7. Guilt/ worthlessness: Feelings of worthlessness or excessive or inappropriate guilt
 8. Concentration: diminished ability to think or concentrate, or more indecisiveness
 9. Suicidality: Thoughts of death or suicide, or has suicide plan

Diagnostic and Statistical Manual (DSM) of Mental Disorders, 4th Edition

DSM is rigid and limited



Home > Research Priorities

Research Domain Criteria (RDoC)

RDoC is a research framework for new ways of studying mental disorders. It integrates many levels of information (from genomics to self-report) to better understand basic dimensions of functioning underlying the full range of human behavior from normal to abnormal.



What's New with RDoC?

- ▶ [Webinar: Analyzing and Using RDoC Data in Your Research](#)
- ▶ [New Funding Opportunities for Psychosis-Related RDoC Projects](#)
- ▶ [RDoC Launches User-Friendly Matrix Format](#)
- ▶ [Psychophysiology: Special Issue Features RDoC Initiative](#)

Join the RDoC Discussion

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[Learn More About RDoC](#)

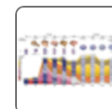
Science News



[Designer analgesic optimizes specificity](#)



[Early Life Experience Matures Memory](#)



[Atlas Reveals Risk Gene Timing](#)

[+ MORE](#)

Rise of RDoC

[Learn More About...](#)

- ▶ [Highlighted Research Initiatives](#)
- ▶ [NIH/NIMH Therapeutics](#)

Negative Valence Systems

Construct/Subconstruct	Genes	Molecules	Cells	Circuits	Physiology	Behavior	Self-Report	Paradigms
Acute Threat ("Fear")	Elements	Elements	Elements	Elements	Elements	Elements	Elements	Elements
Potential Threat ("Anxiety")	Elements	Elements	Elements	Elements	Elements			Elements
Sustained Threat		Elements	Elements	Elements	Elements	Elements		
Loss	Elements	Elements		Elements	Elements	Elements	Elements	
Frustrative Nonreward	Elements	Elements		Elements		Elements	Elements	Elements

Domains

Negative Valence Systems

Positive Valence Systems

Cognitive Systems

Social Processes

Arousal and Regulatory Systems

Units of Analysis

Genes

Molecules

Cells

Circuits

Physiology

Behaviors

Self-Reports

Paradigms

Physiology

BP Context Startle EMG Eye Tracking Facial EMG Fear Potentiated Startle Heart Rate
pupillometry Respiration Response accuracy Skin Conductance

Behavior

Analgesia approach (early development) Avoidance Facial expressions Freezing Open field
Response inhibition Response time Risk assessment Social approach

Self-Report

Albany Panic and Phobia BAI Eilam Ethogram Fear Questionnaire Fear survey schedule
STAI Structured Diagnostic and Assessment scales SUDS Trait Fear Inventory



CampusLife

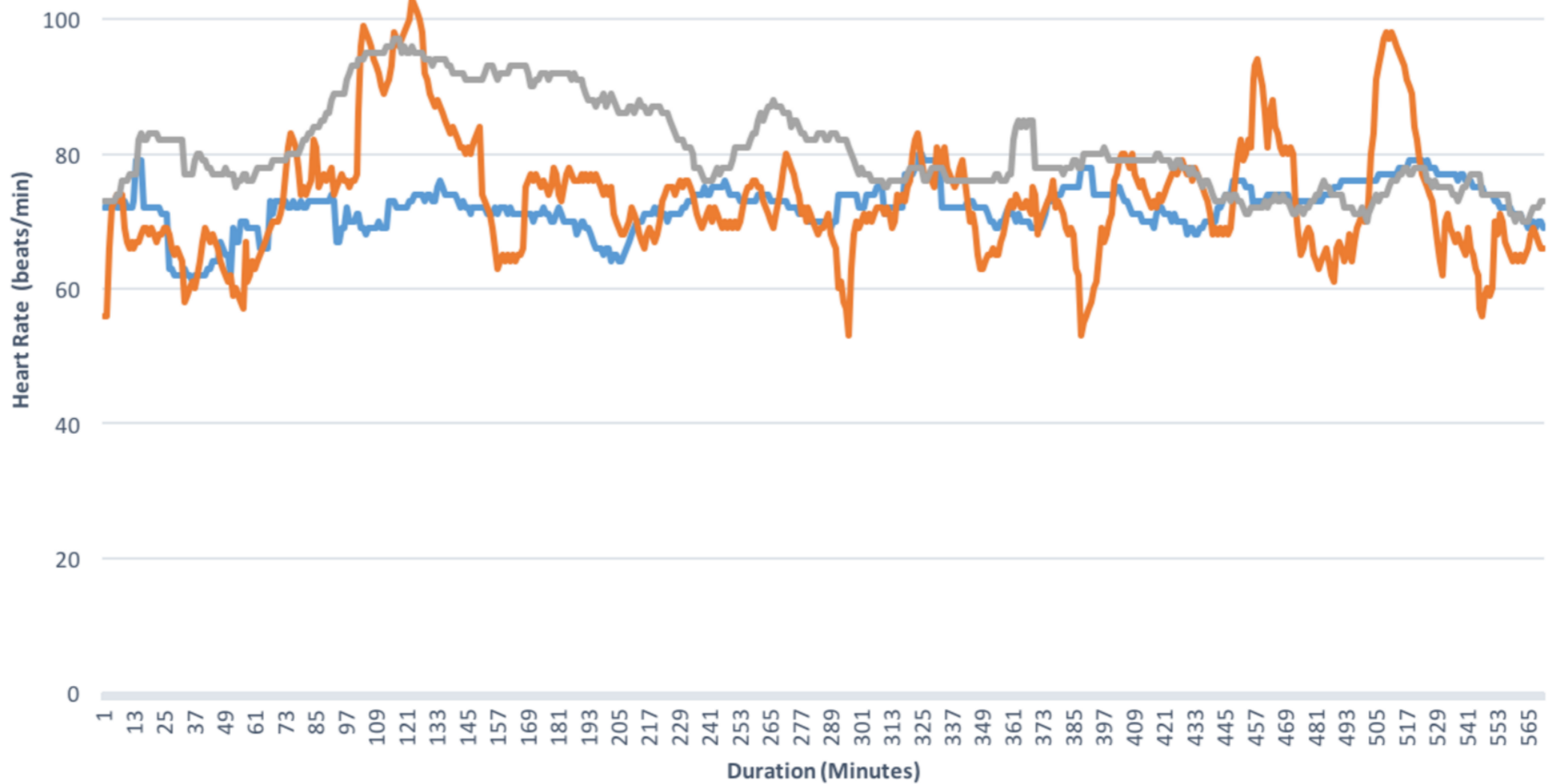
@dartmouth

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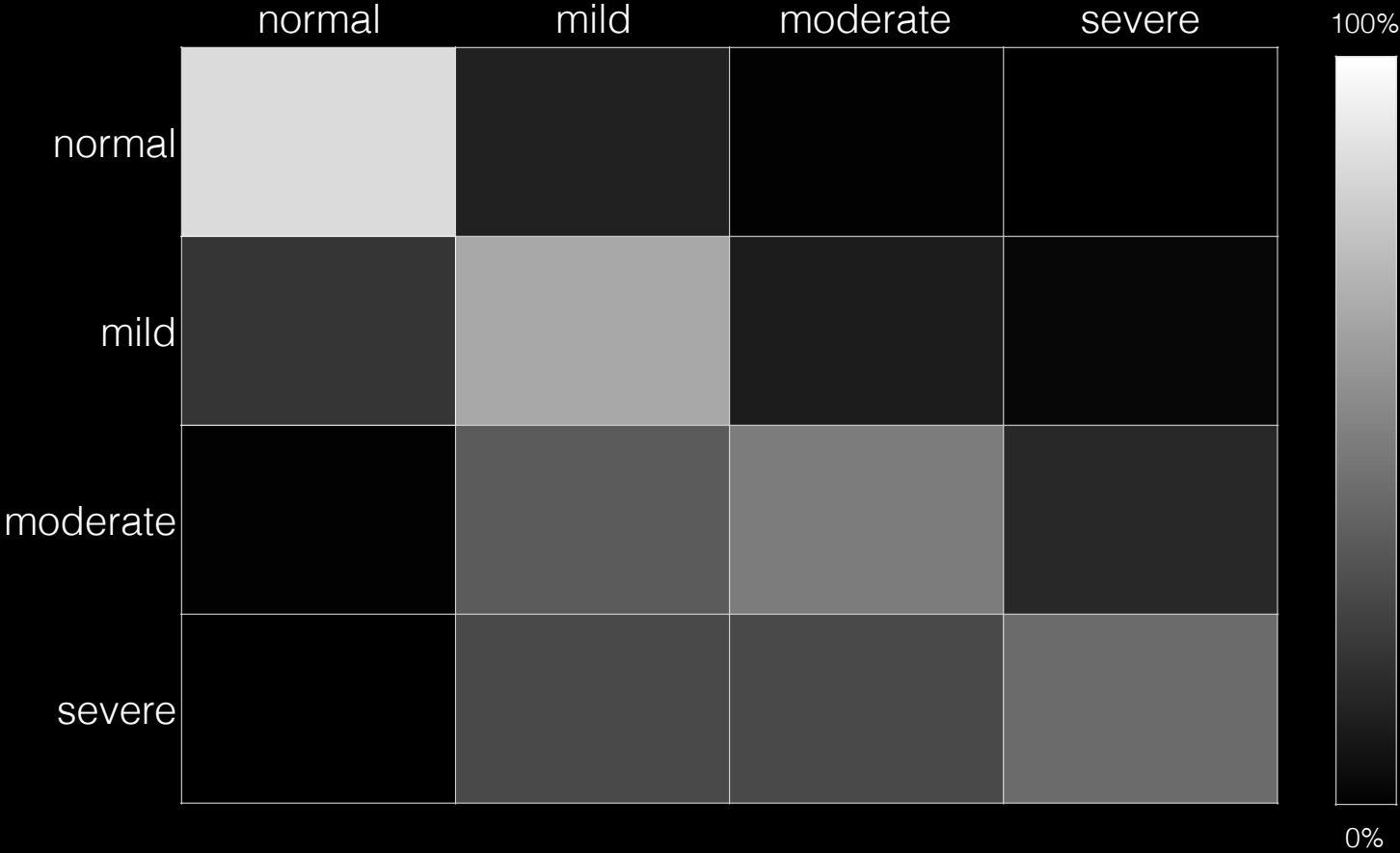
promise of wearables

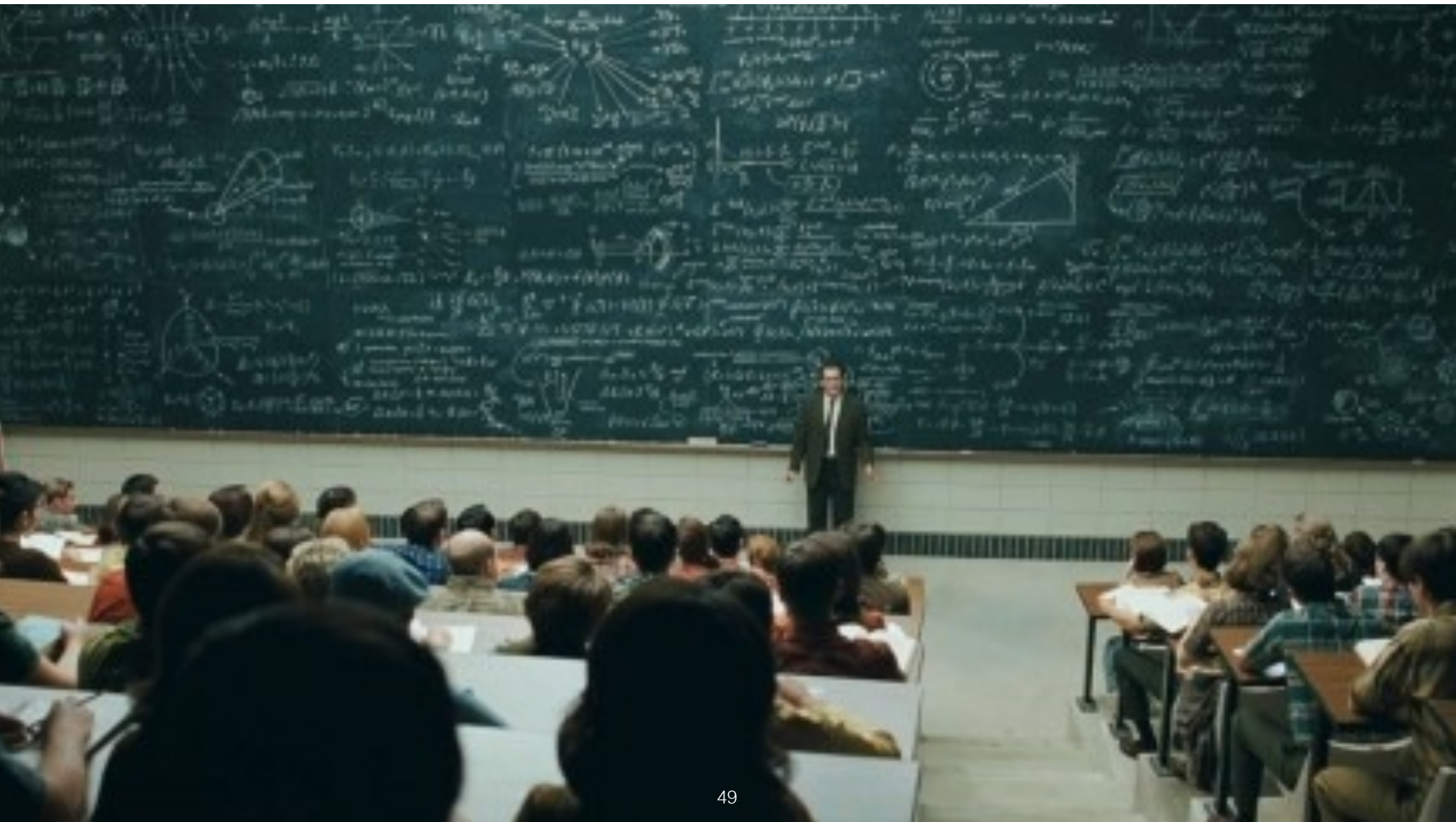




Band 1 Moto 360 Band 2

depression state transitions based on weekly PHQ4 data



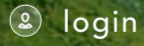


- 
- validity of sensors and diagnostic predictive models
 - flaky signals, real-world noise
 - interventions
 - over burdened clinicians
 - privacy, privacy, privacy



we have a mountain to climb



The word "Calm" is written in a white, elegant cursive script font in the top left corner of the page.A small circular icon containing a person silhouette is positioned to the left of the word "login", which is written in a simple, lowercase sans-serif font.

Welcome to Calm

Relax with Calm, a simple mindfulness meditation app that brings clarity and peace of mind into your life.

Begin

[Subscribe](#) [Blog](#) [FAQ](#) [Gift](#) [Book](#) [Jobs](#) [Terms](#) [Social](#)



buddhify is the mindfulness app for modern life



Sleepio™



How do you feel?

Feel recognizes and tracks your emotions throughout the day and provides you with personalized coaching to help you achieve your emotional wellbeing goals.

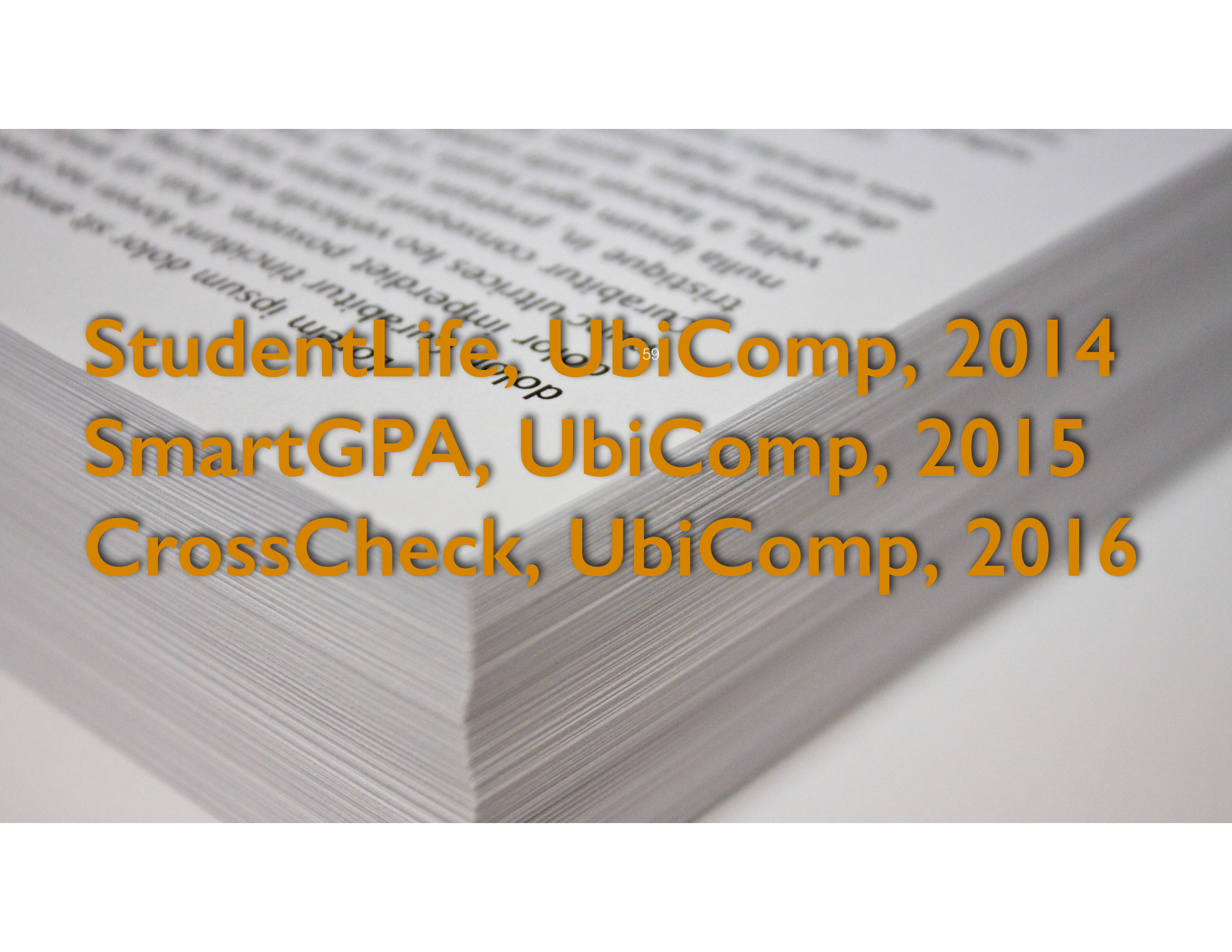
[RESERVE NOW](#)

**randomized
control trials**



**#Big
Thank
You**

Ethan Berke, Dror Ben-Zeev, Tanzeem Choudhury, Randy Colvin, John Kane, Sam Gosling, Gabriella Harari, Catherine Norris, Rui Wang, Varun Mishra, Weichen Wang, Xia Zhou, Susan Zak, Gregory Abowd, Emily A. Schere, Rachel M. Brian, Tom Insel, Min S. H. Aung, Mi Zhang, Todd Heatherton, Bill Kelley, Virginia Brack, Ann Bracken, Sarah Lord, Lorie Loeb

The background of the slide is a stack of papers. The top paper is slightly out of focus, showing some Latin text. The stack is thick, and the edges of the pages are visible. The overall tone is light and professional.

StudentLife, UbiComp, 2014
SmartGPA, UbiComp, 2015
CrossCheck, UbiComp, 2016





peace brother

