

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?









A photograph of a classroom filled with diverse students of various ages and ethnicities, all seated at their desks and looking towards the front of the room. They are engaged in a lecture or presentation. The room is a typical university lecture hall with rows of desks and overhead projectors.

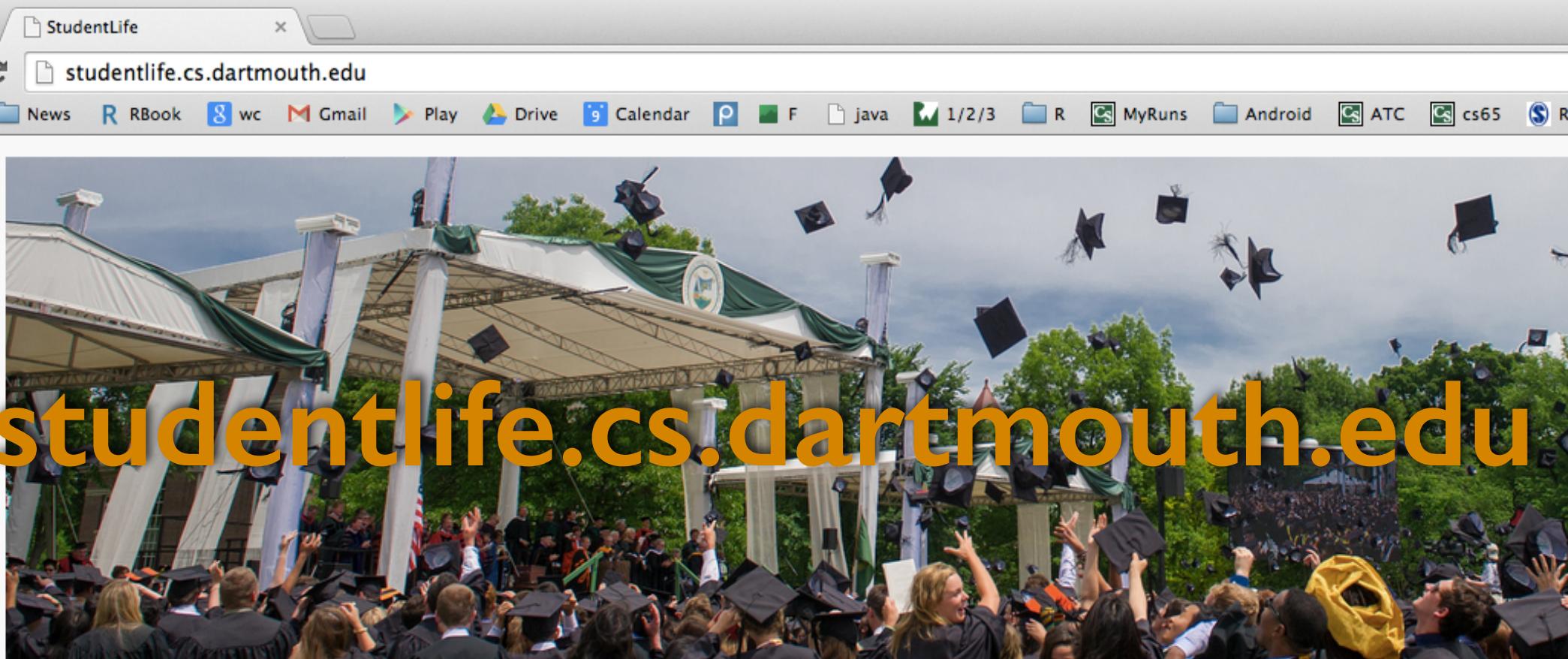
fast forward 30 years

A photograph of a snowy Dartmouth campus. In the foreground, a student wearing a blue jacket and a white beanie walks away from the camera on a snow-covered path. Bare trees stand in the background, and a large, white, multi-story building with a green-roofed tower is visible under a clear blue sky.

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

12% reported depression has having an impact on academic performance

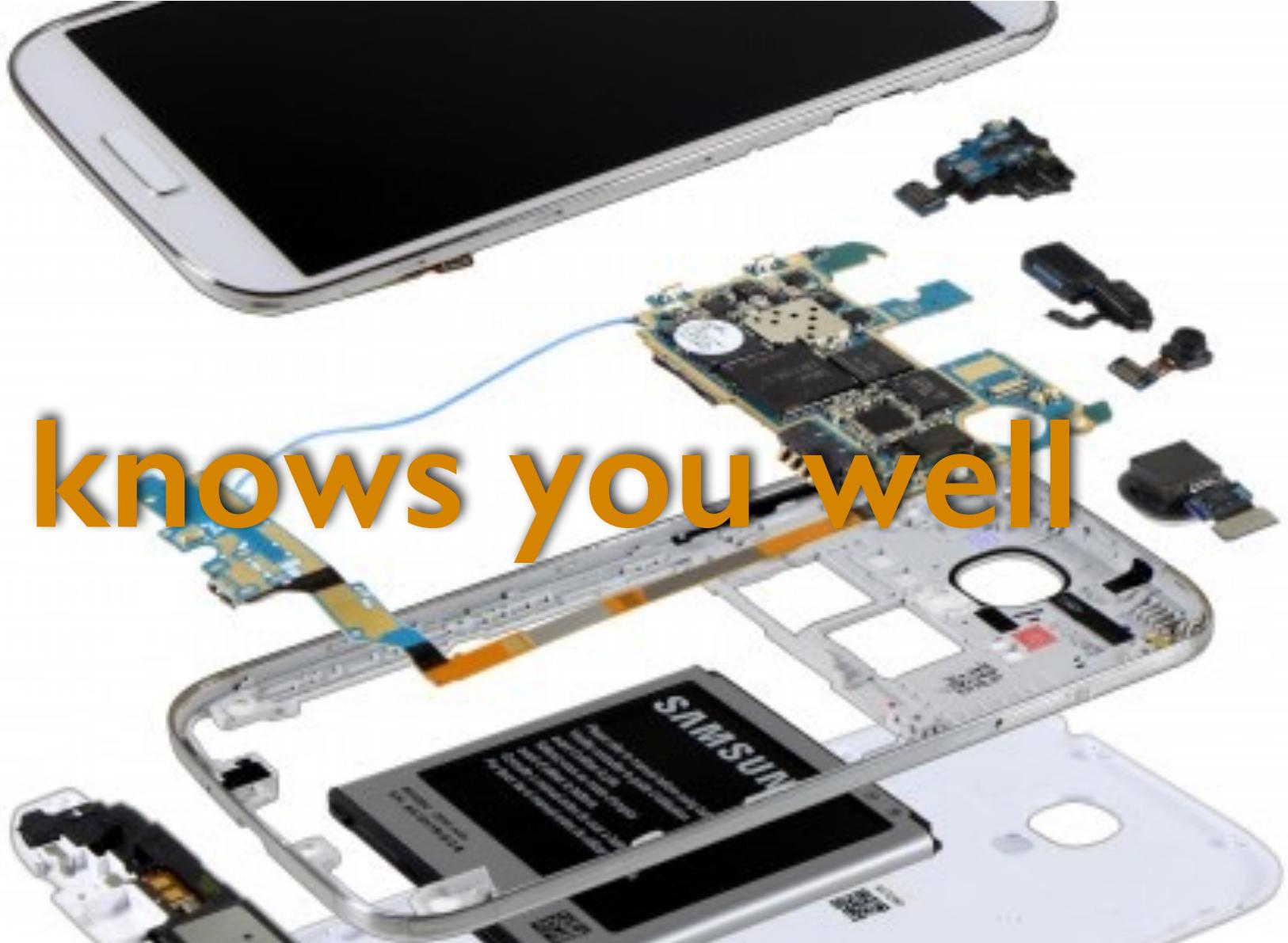
28% have seen a mental health counselor in 2014



studentlife.cs.dartmouth.edu

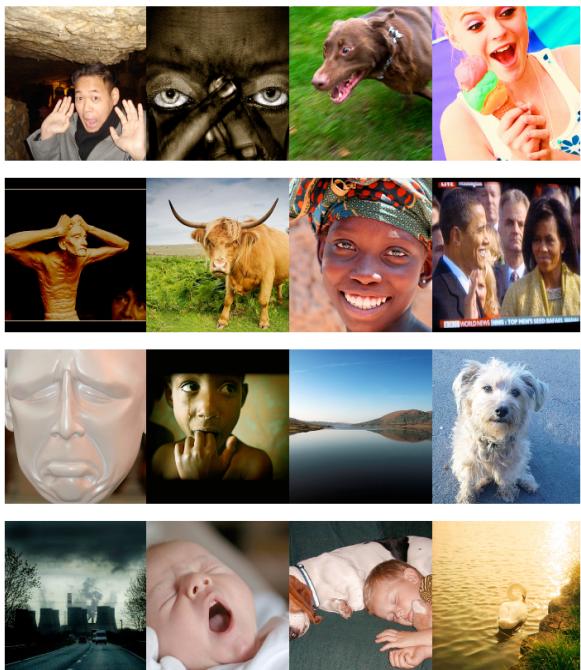
StudentLife

StudentLife is the first study that uses passive and automatic sensing data from the phones of a class of 48 Dartmouth students to assess their mental health (e.g., depression, loneliness, stress), academic performance (grades across all three years 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?

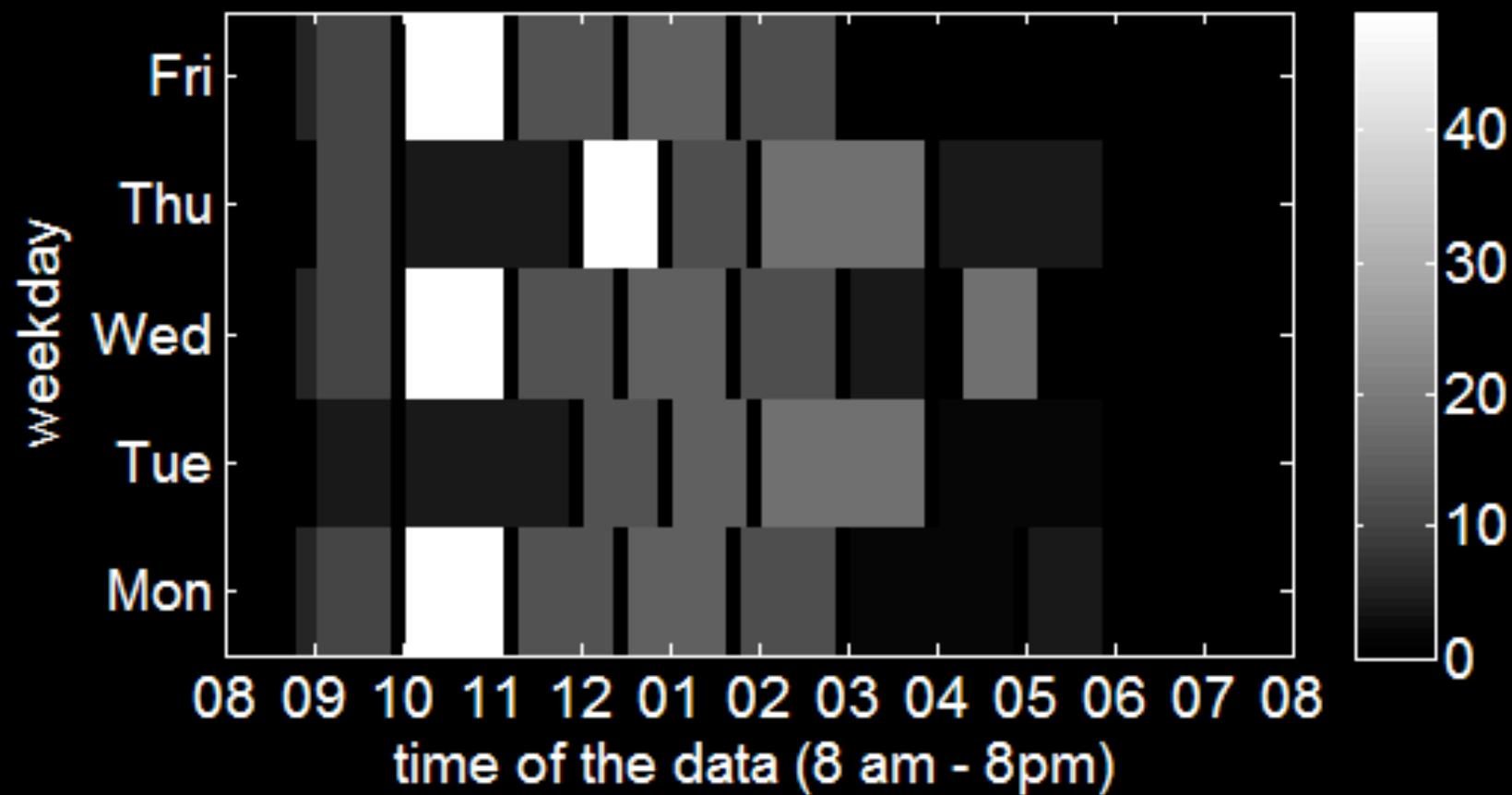
Very good

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

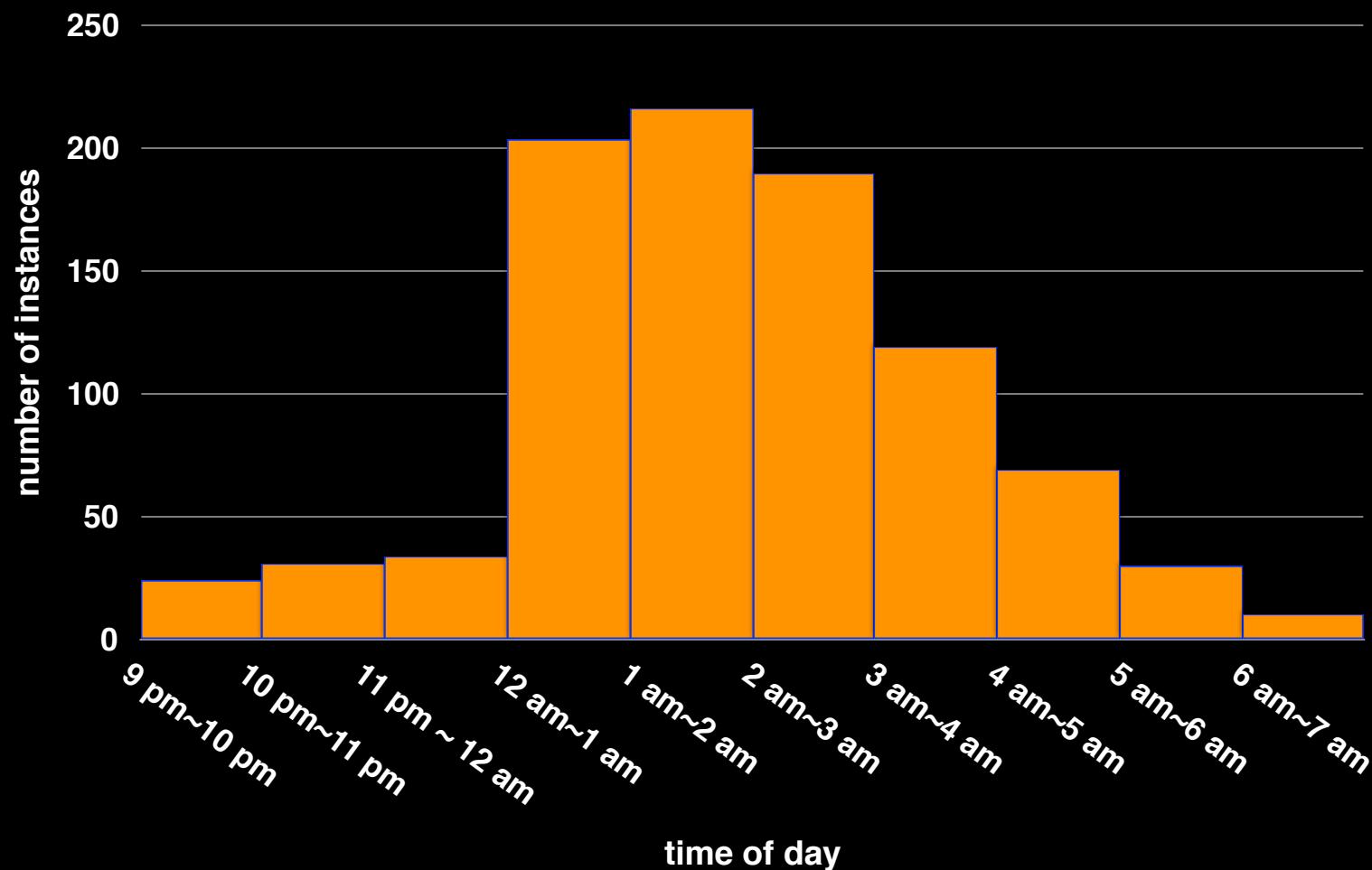
None

Save Response

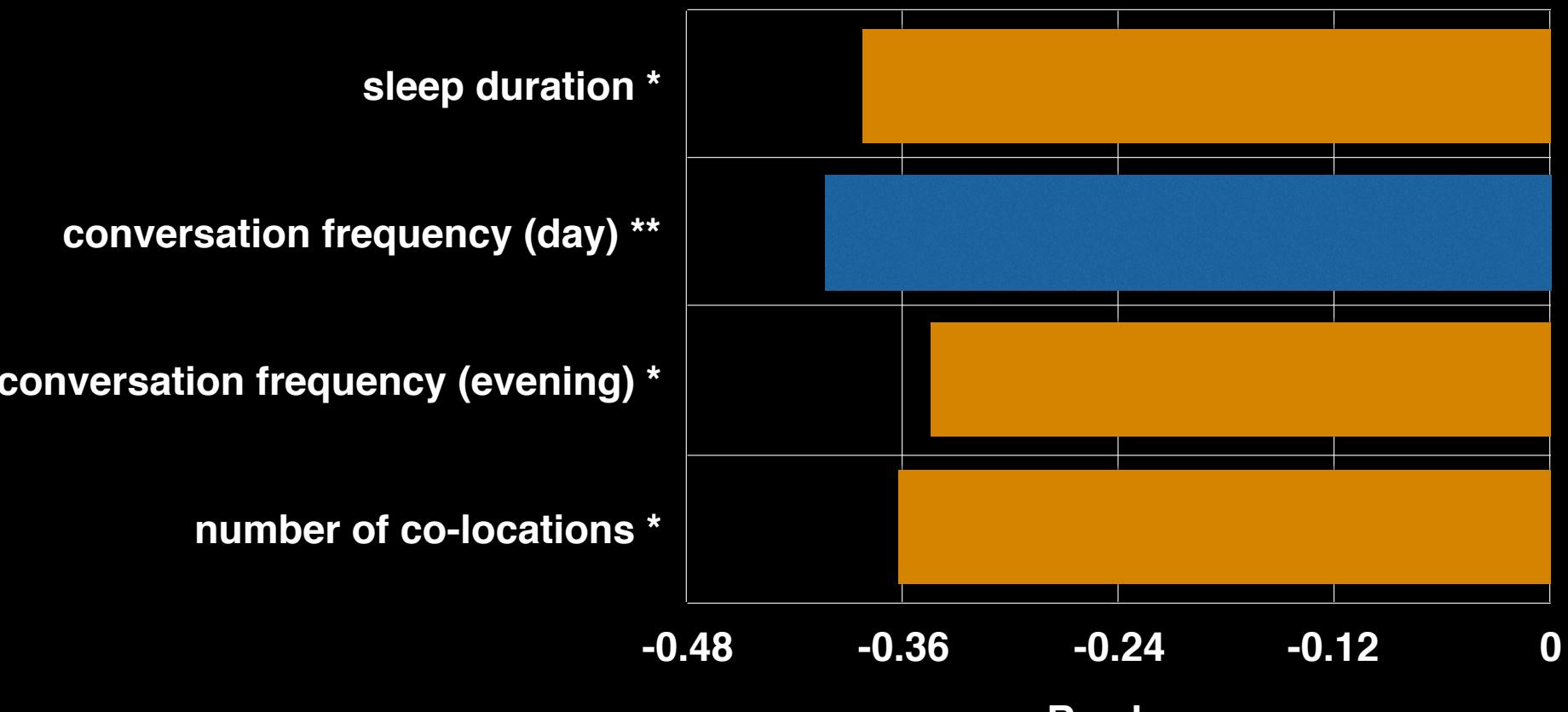
attendance rates



sleep

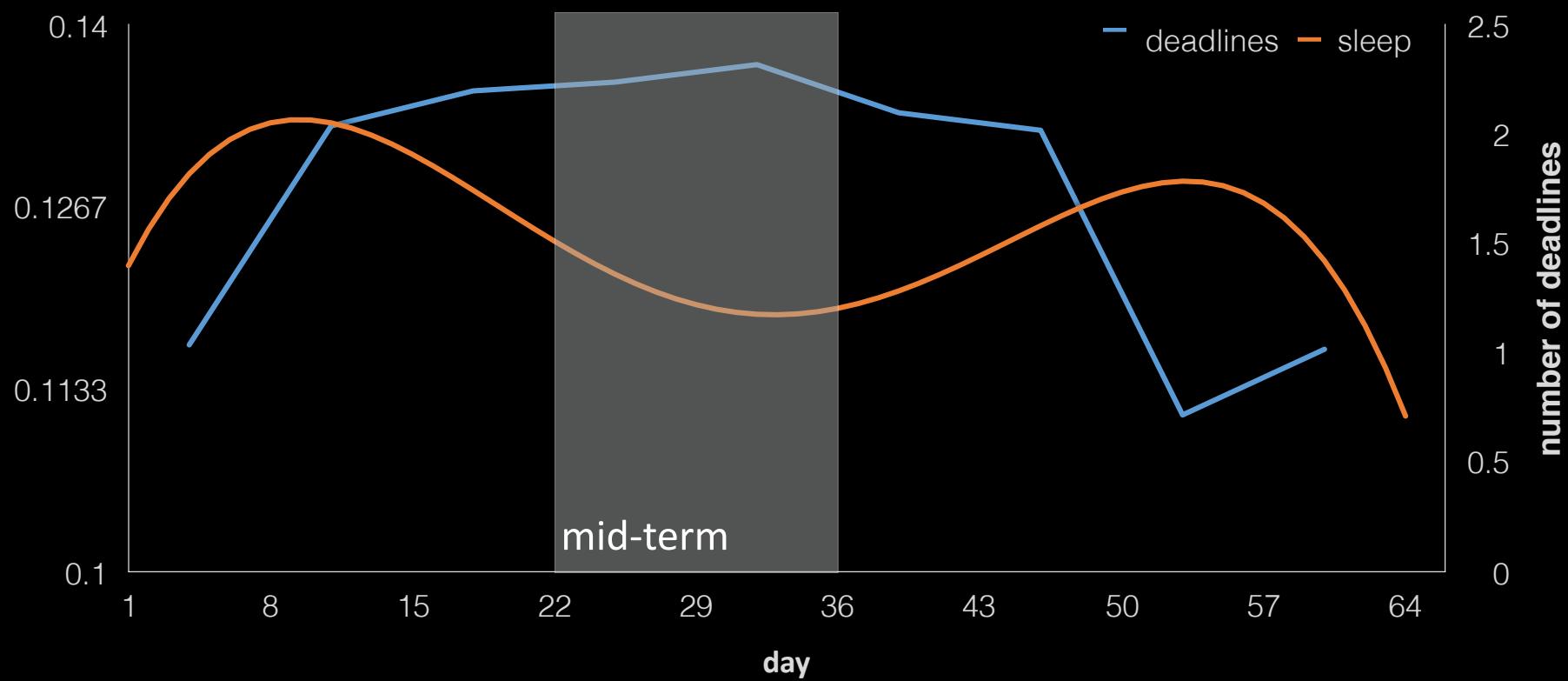


depression

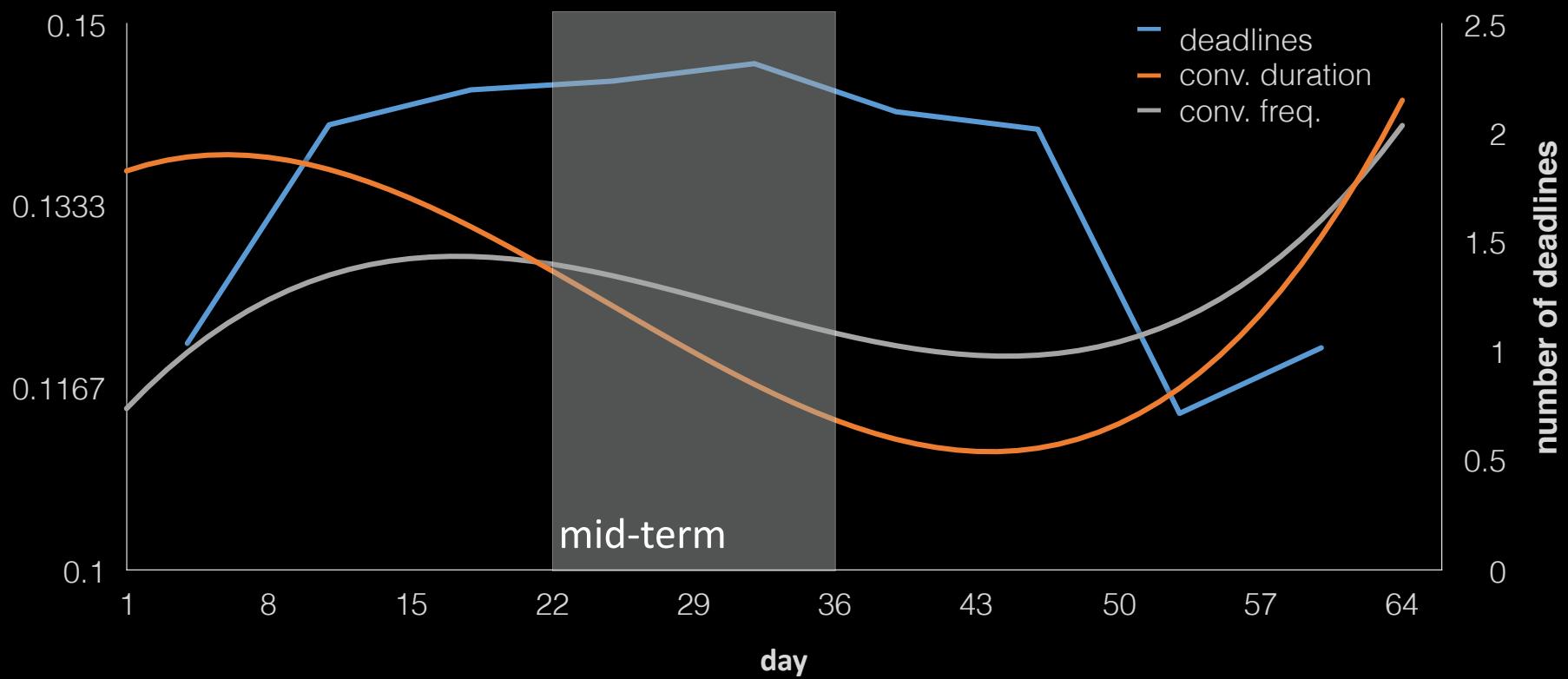


* $p \leq 0.05$, ** $p \leq 0.01$

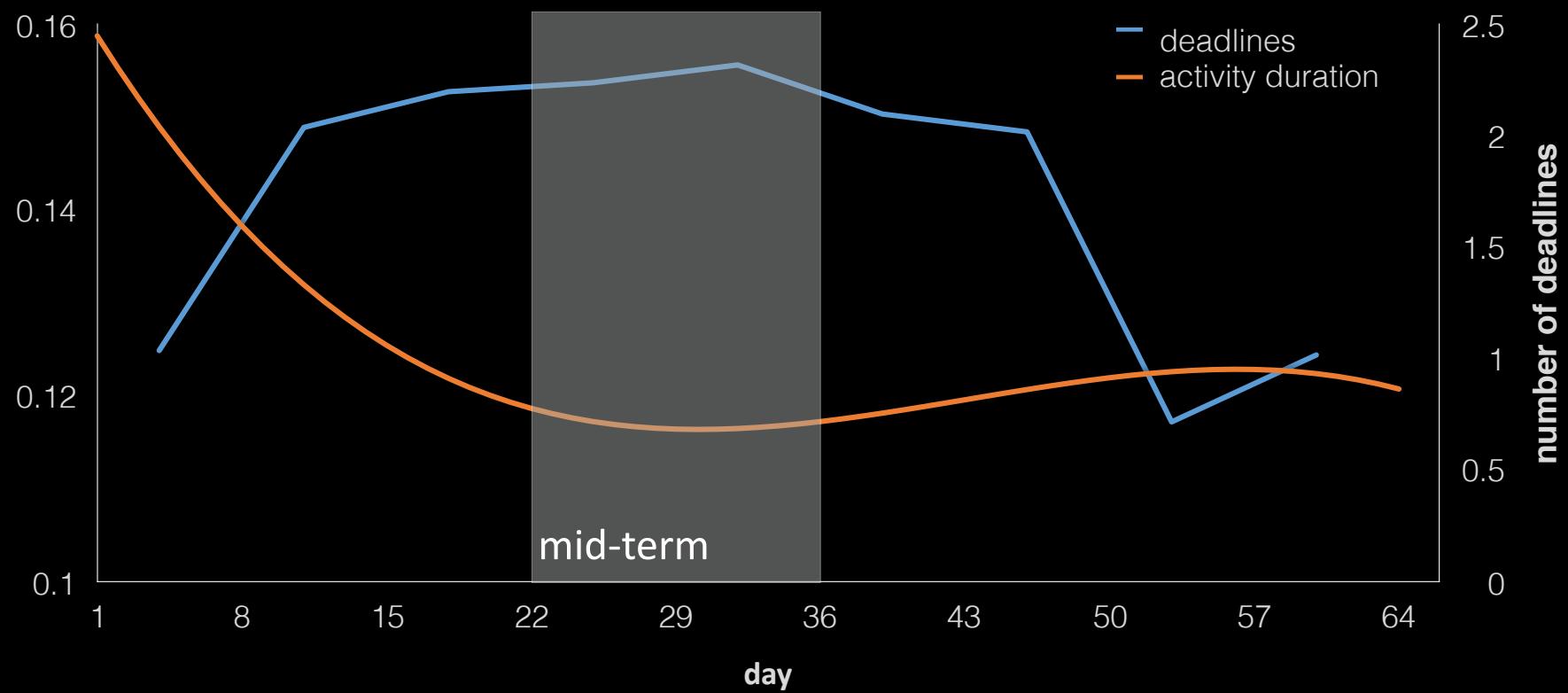
sleep



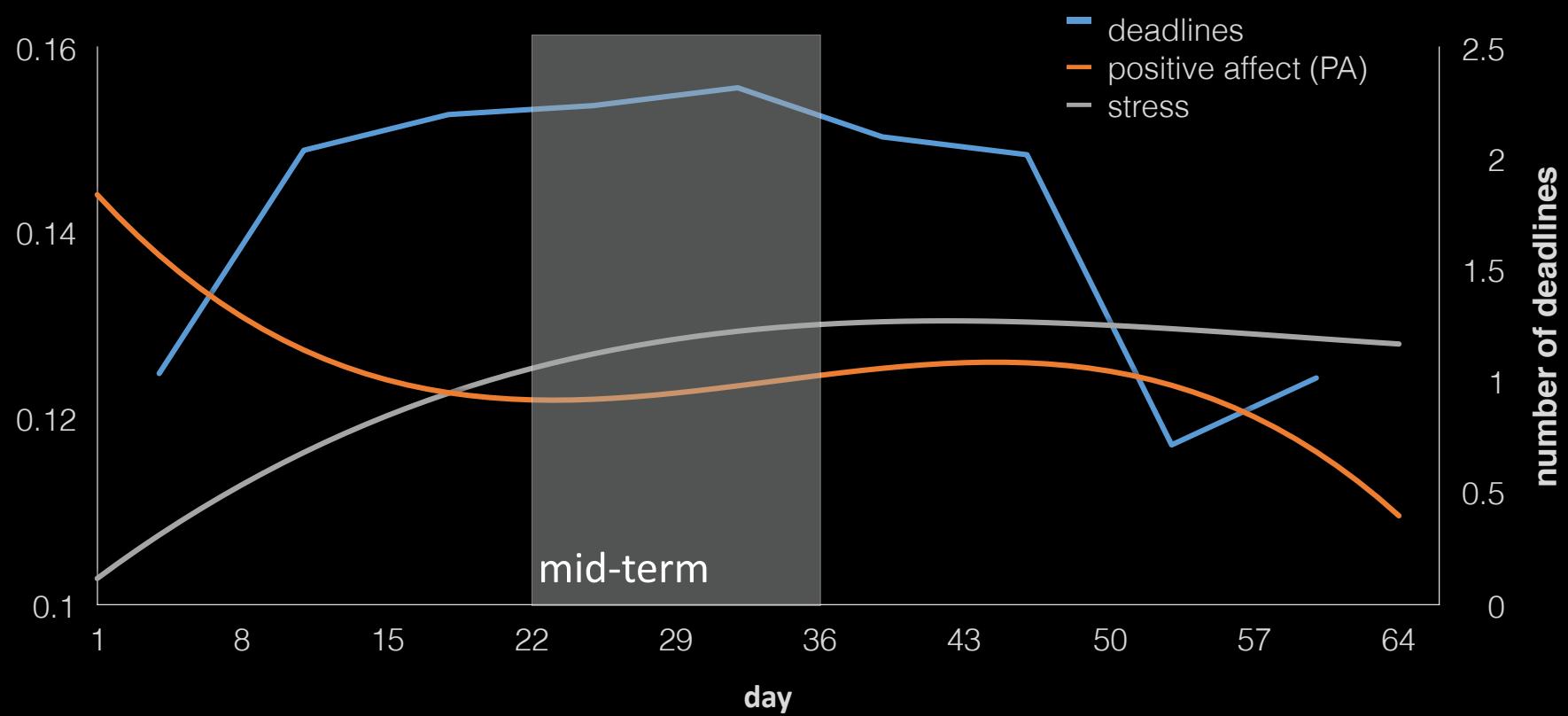
face-to-face conversation



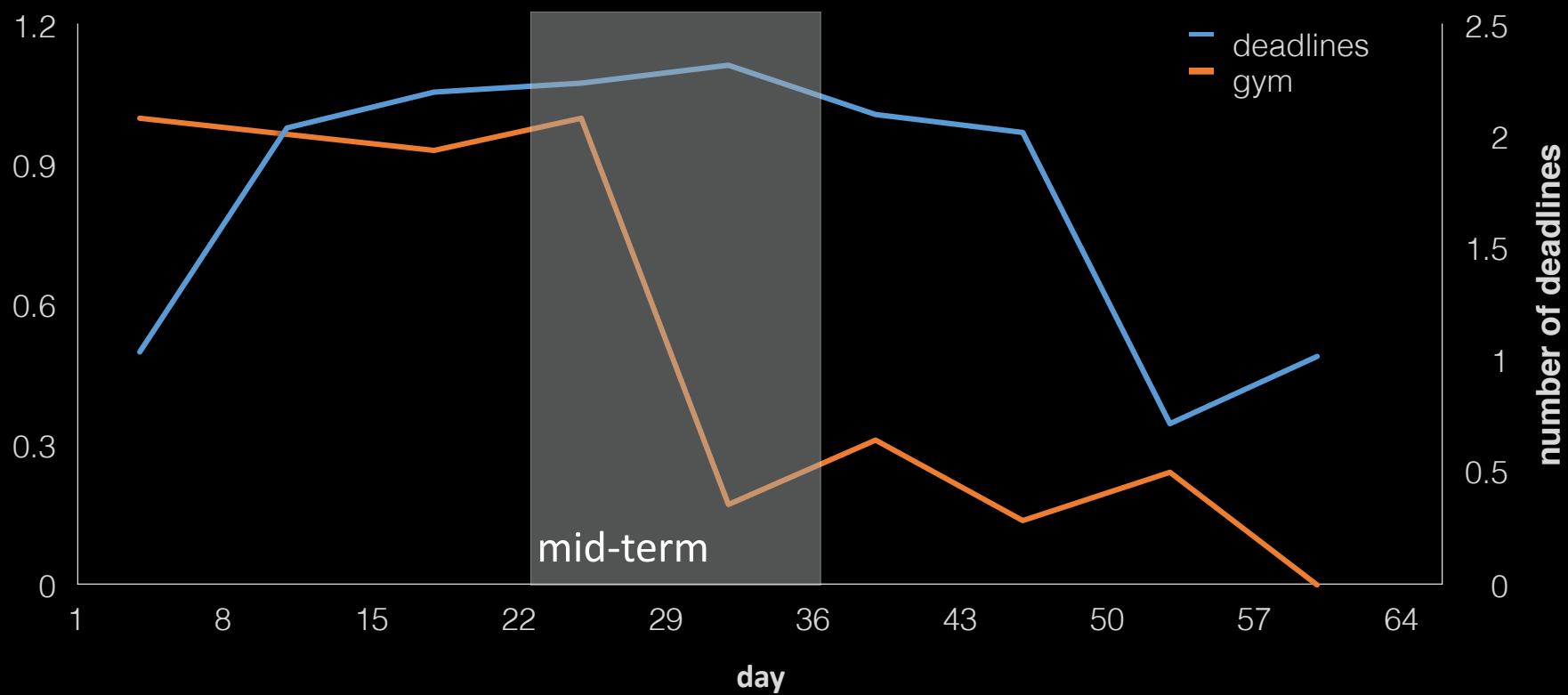
activity duration



stress and affect



gym visits

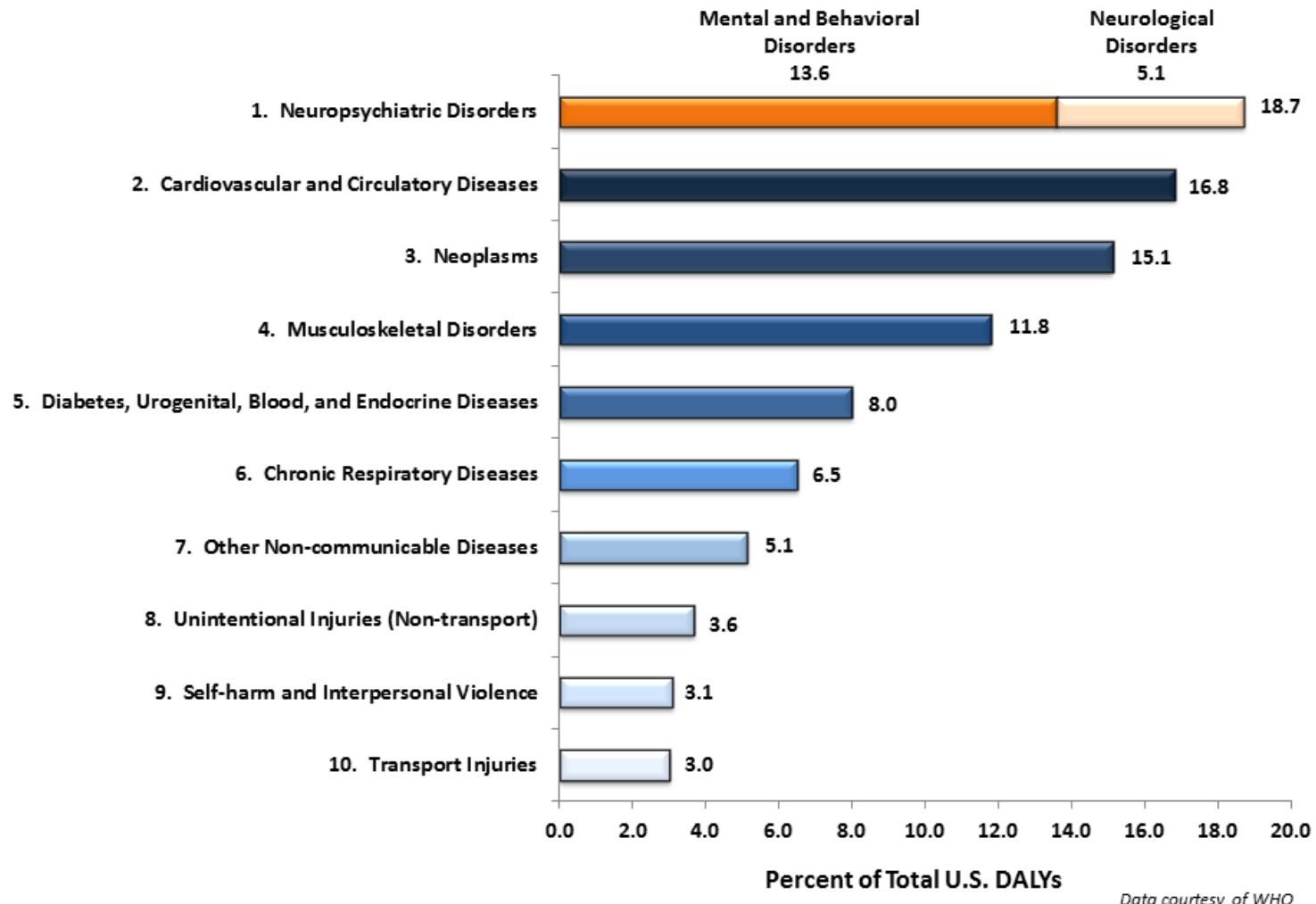






the silent tsunami

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

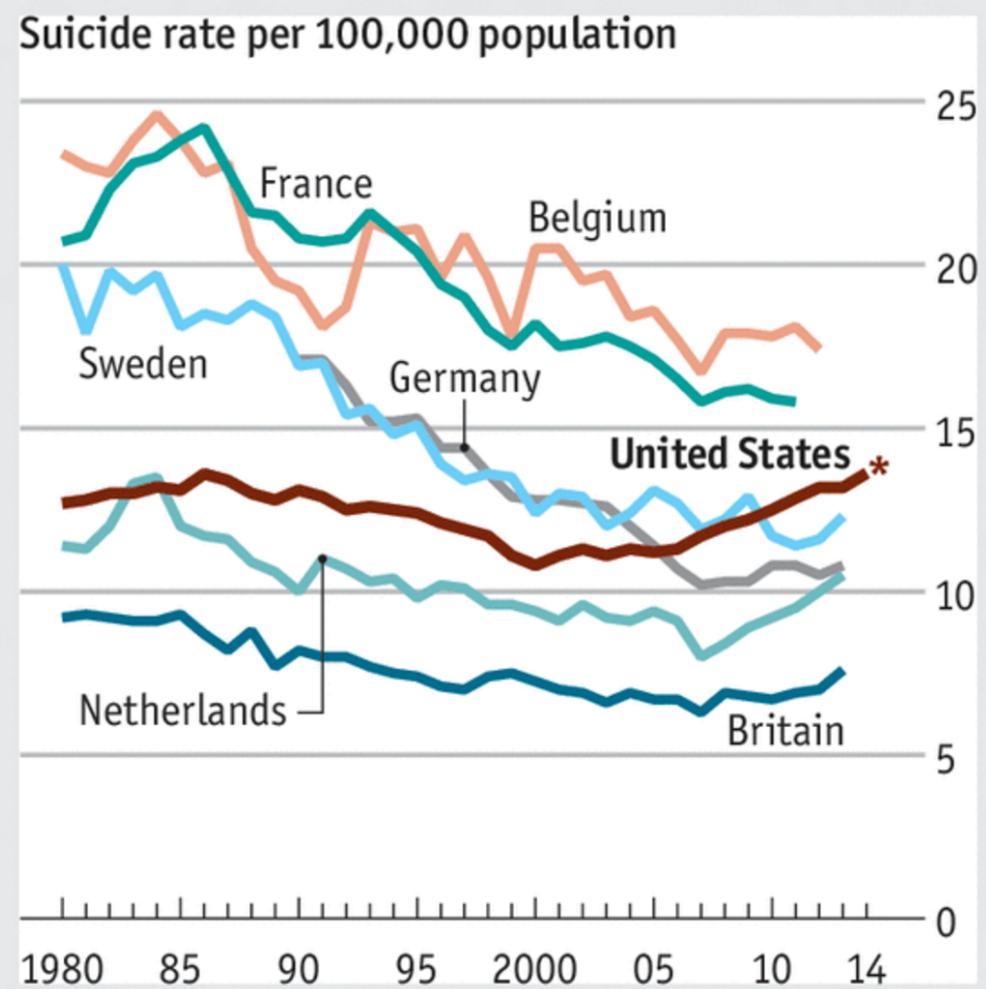


Data courtesy of WHO

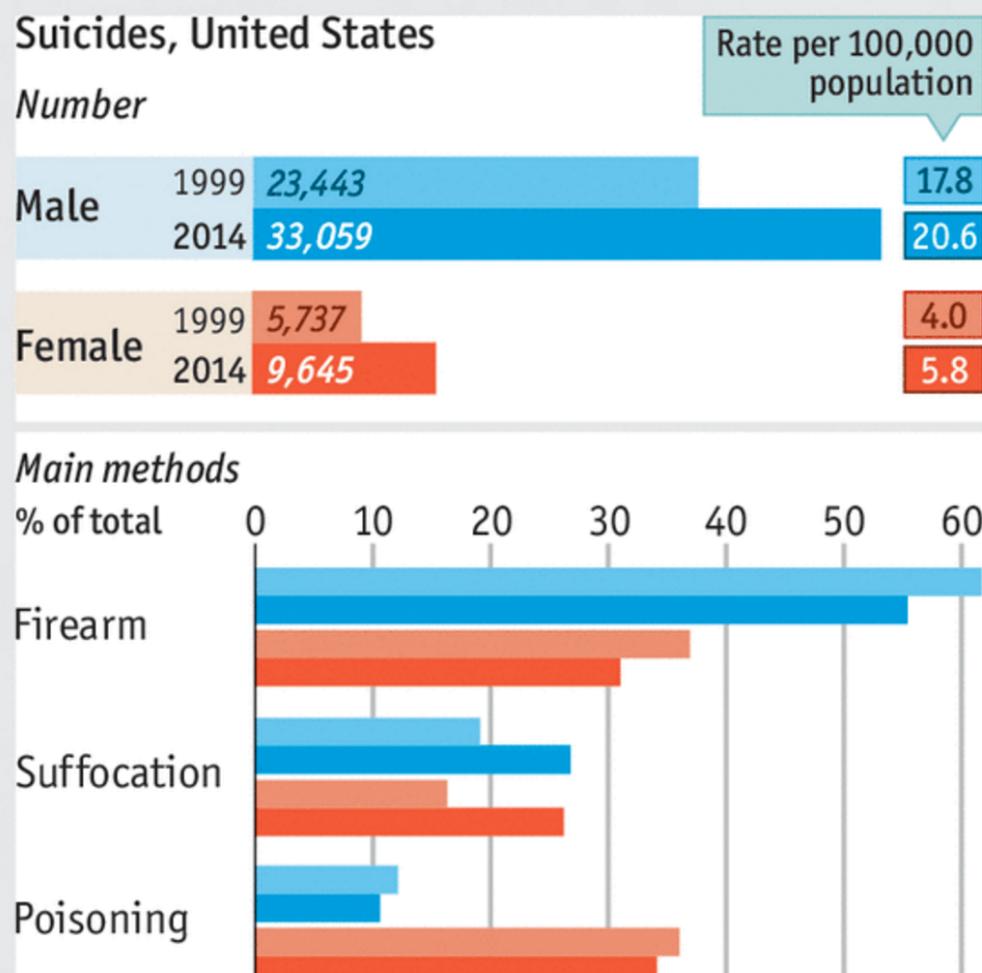




A tragic trend

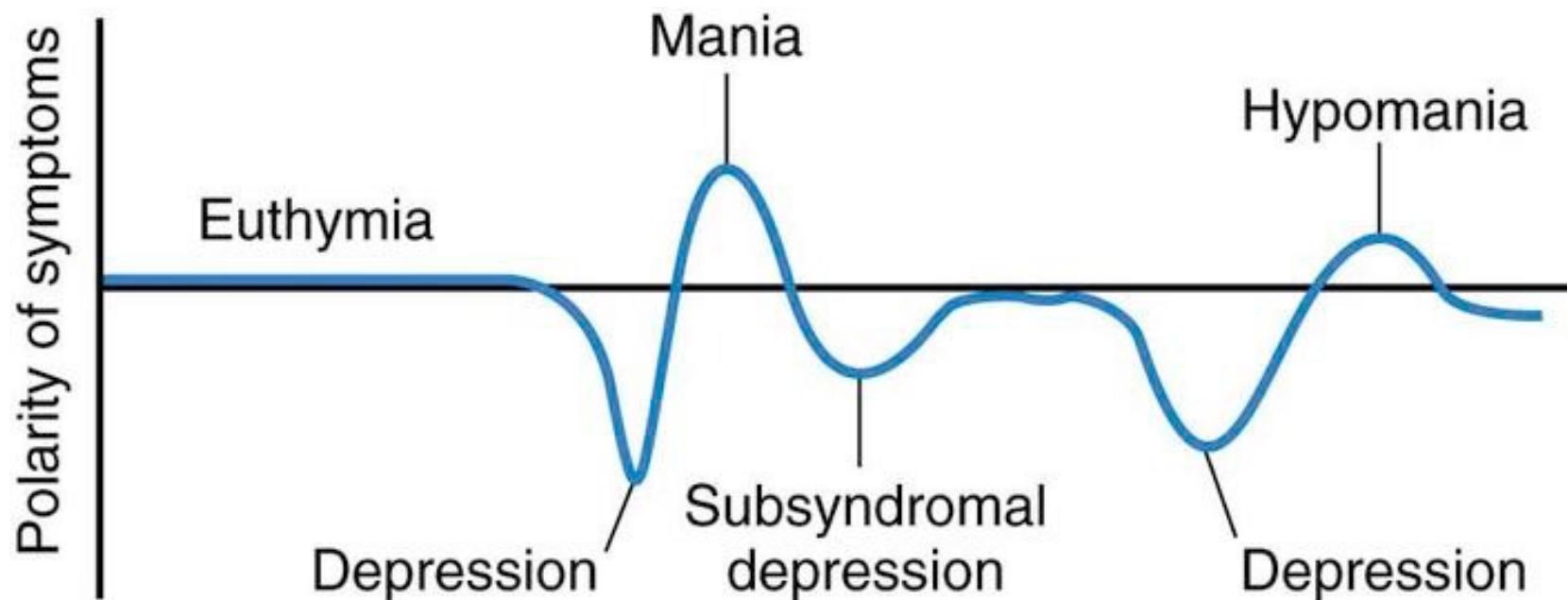


Sources: OECD; US Centres for Disease Control and Prevention



*2011-14 *Economist* estimates using CDC data



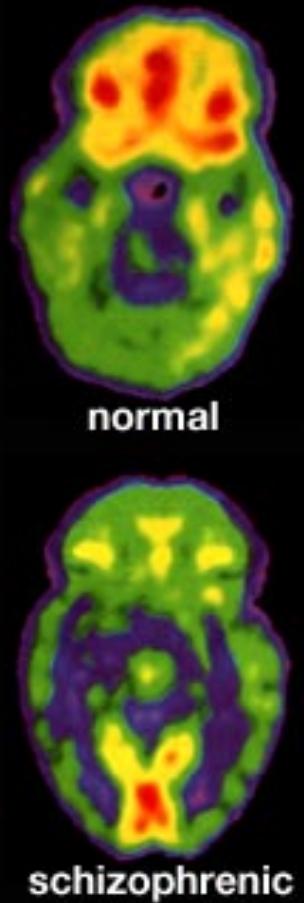


he always went off his meds

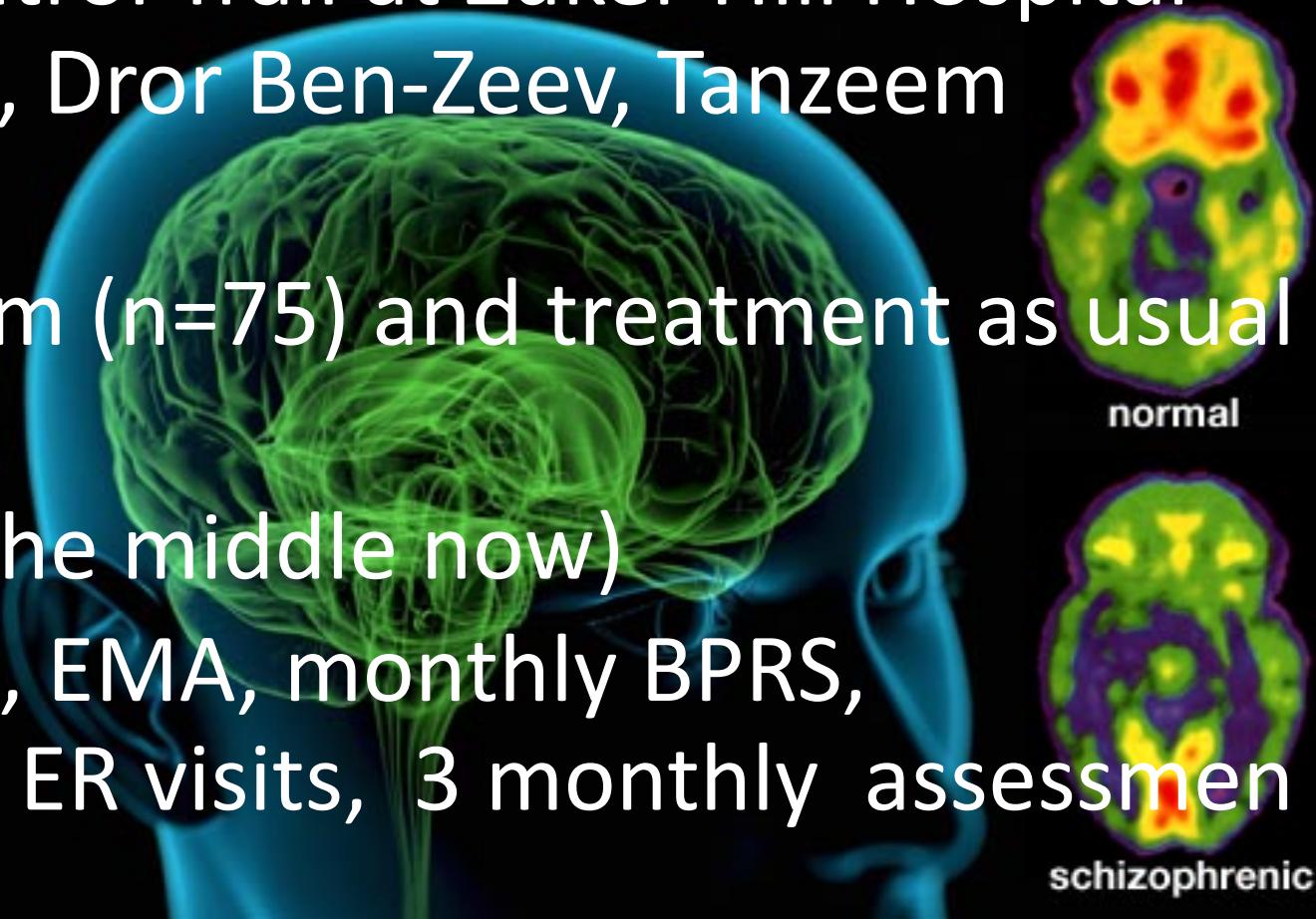
electroconvulsive therapy (ECT), aka electroshock therapy



Predicting relapse in schizophrenia



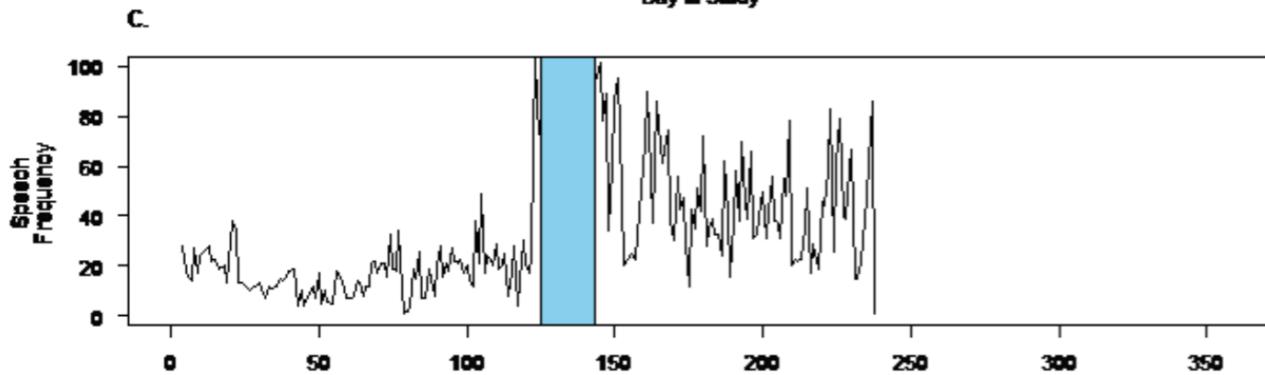
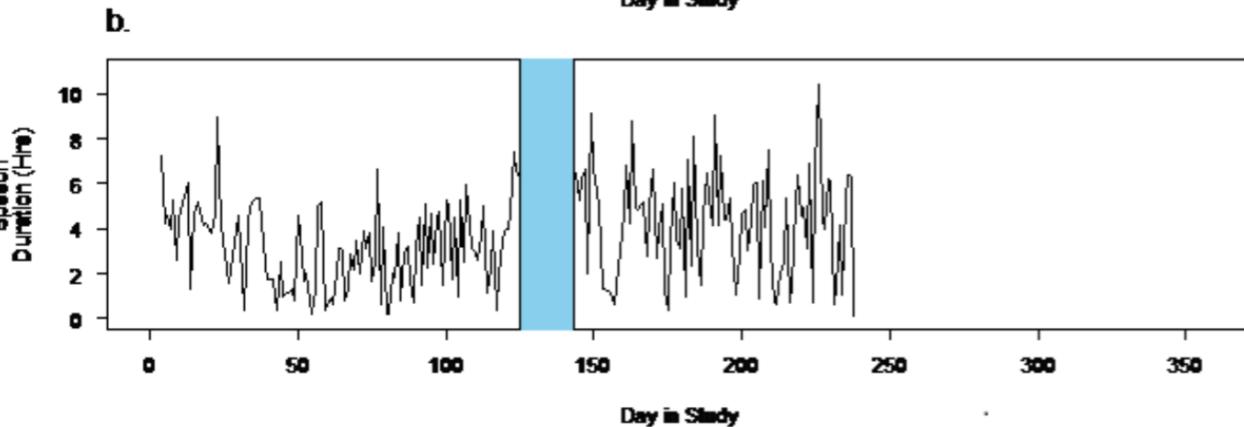
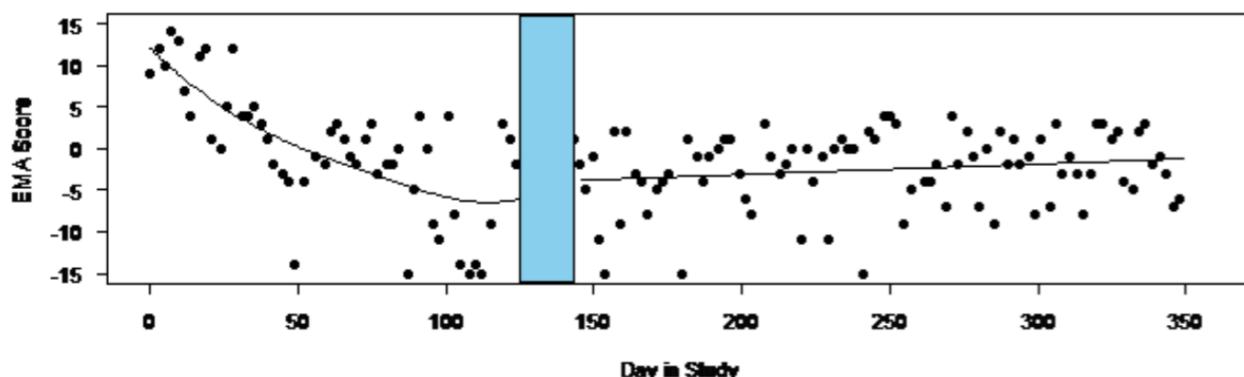
- Randomize Control Trail at Zuker Hill Hospital with John Kane, Dror Ben-Zeev, Tanzeem Choudhry
- Smartphone arm ($n=75$) and treatment as usual arm ($n=75$).
- 12 months (in the middle now)
- Passive sensing, EMA, monthly BPRS, hospitalization, ER visits, 3 monthly assessments

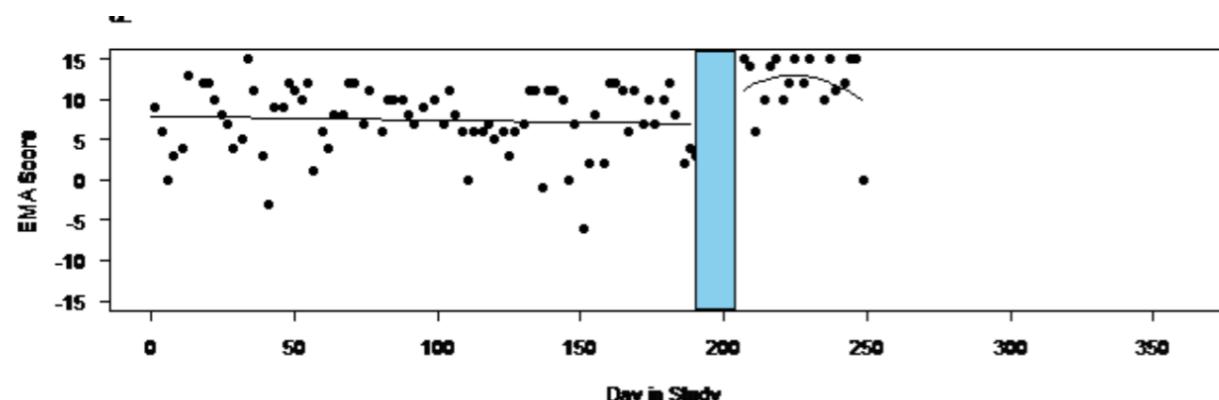


CALM	Have you been feeling CALM?
SOCIAL	Have you been SOCIAL?
VOICES	Have you been bothered by VOICES?
SEEING THINGS	Have you been SEEING THINGS other people can't see?
STRESSED	Have you been feeling STRESSED?
HARM	Have you been worried about people trying to HARM you?
SLEEPING	Have you been SLEEPING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

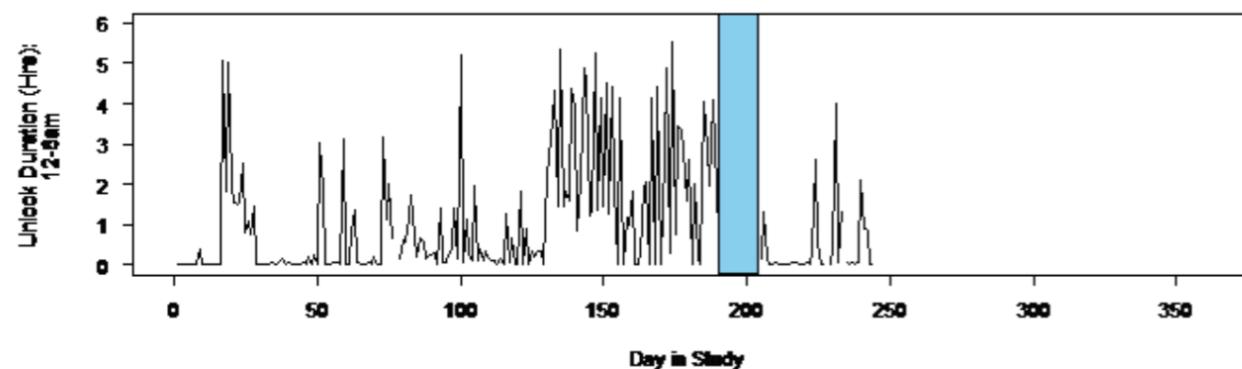
A close-up photograph of a single yellow lemon resting among a cluster of green limes. The lemon is positioned centrally, slightly overlapping the limes. The limes are dark green with some yellowish-green highlights and small brown spots. The background is dark, making the bright yellow lemon stand out.

is there a relapse signal?

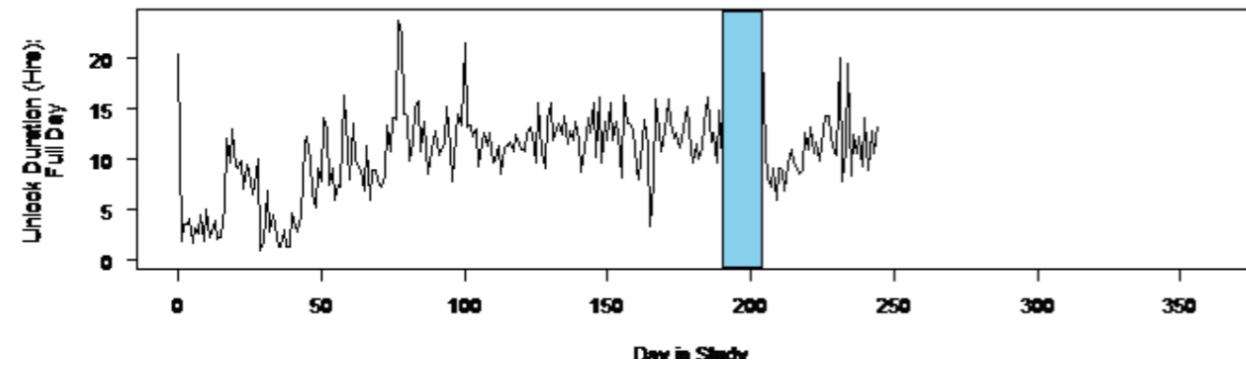


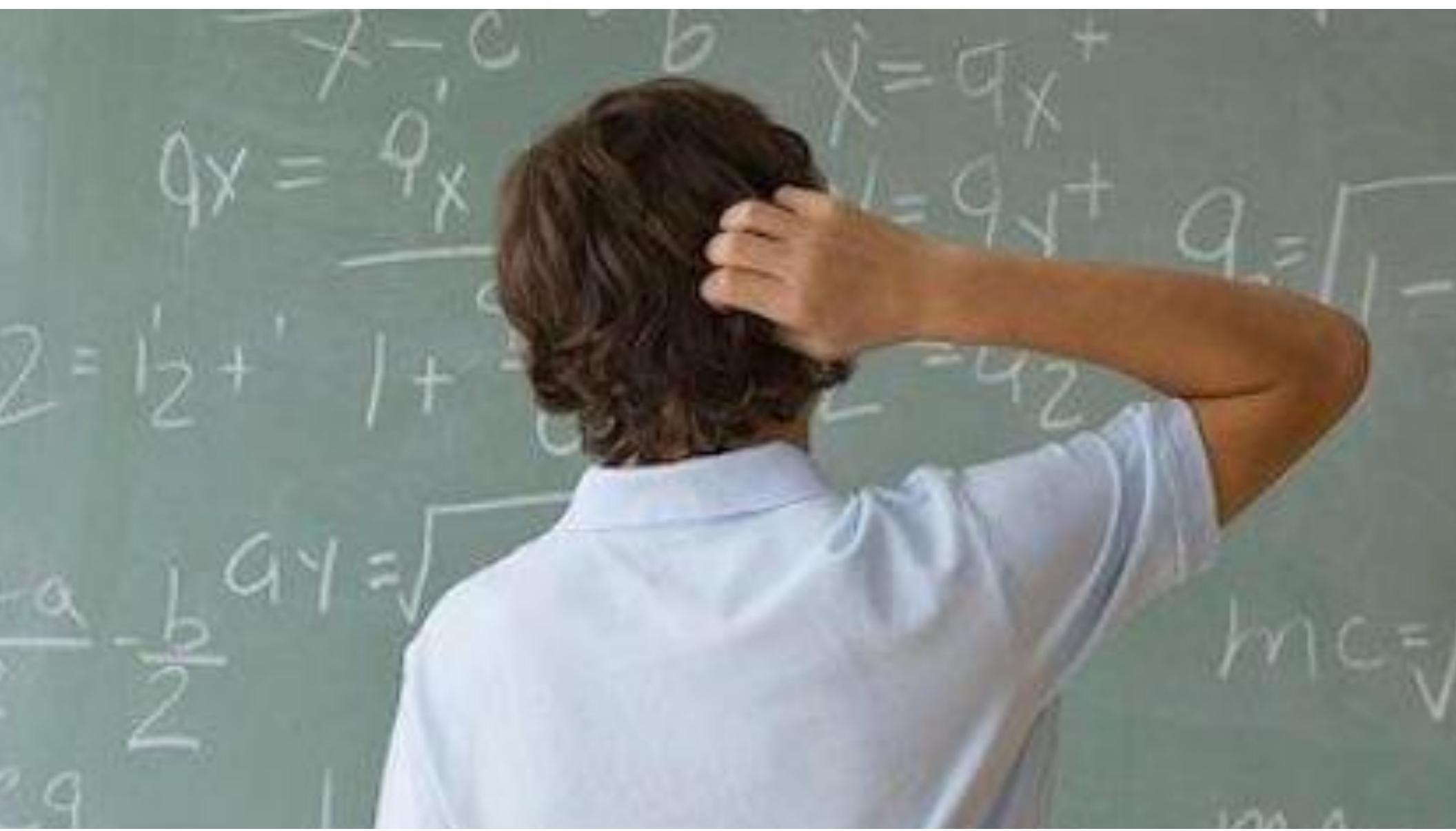


b.

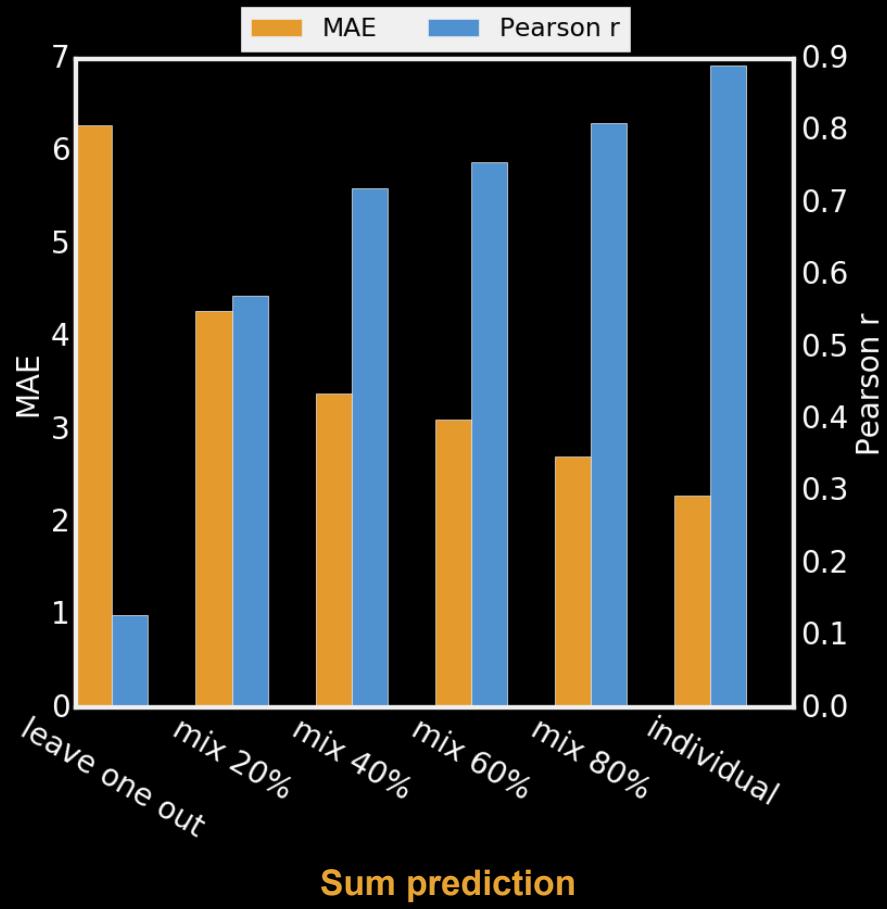
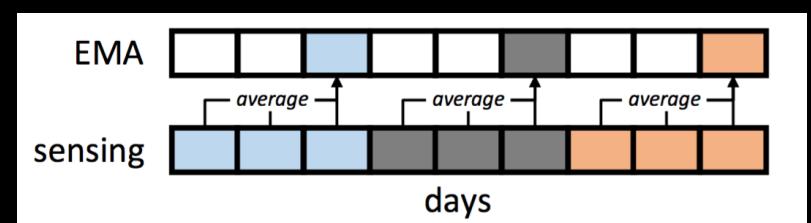
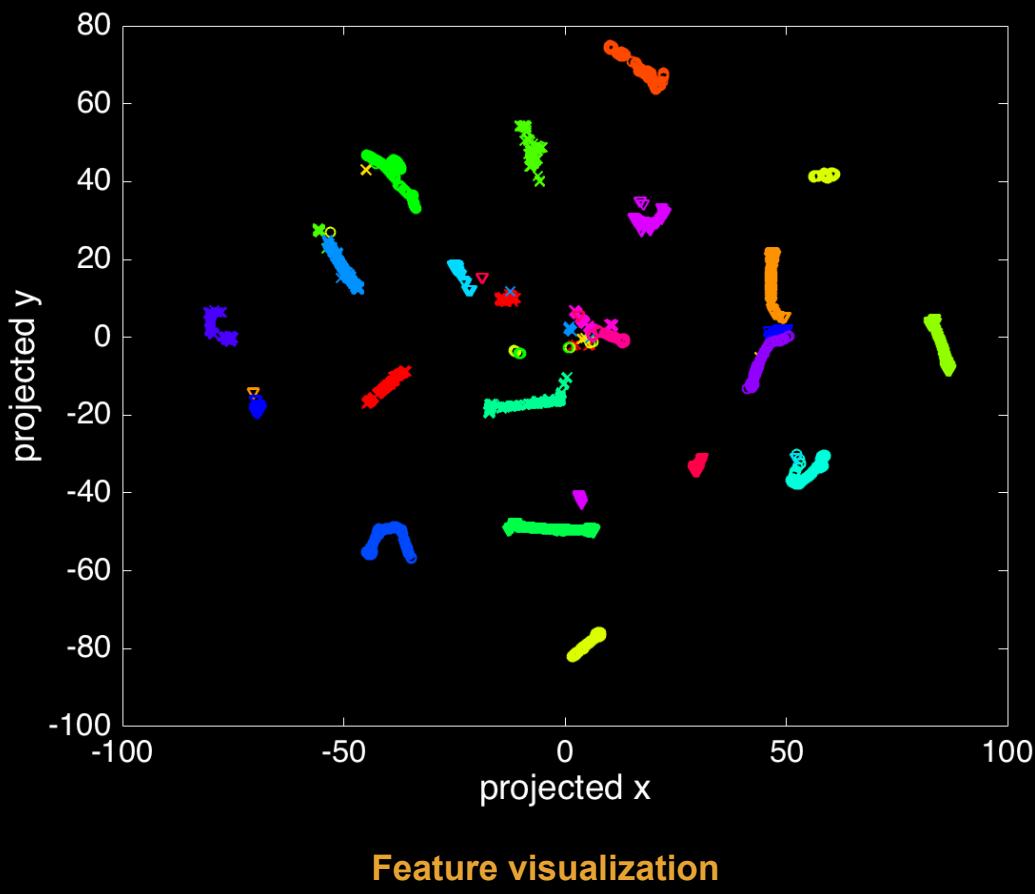


c.





predicting health dimensions



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

Eureka Weekly BPRS Report 20x

<https://mail.google.com/mail/u/0/#inbox/15705c7f28bd459d>

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Notes

More

Andrew

Hane, Mark Matth

Miles Campbell

Miles Campbell

Deepak Ganesan

Eureka Weekly BPRS Report 2016-09-07

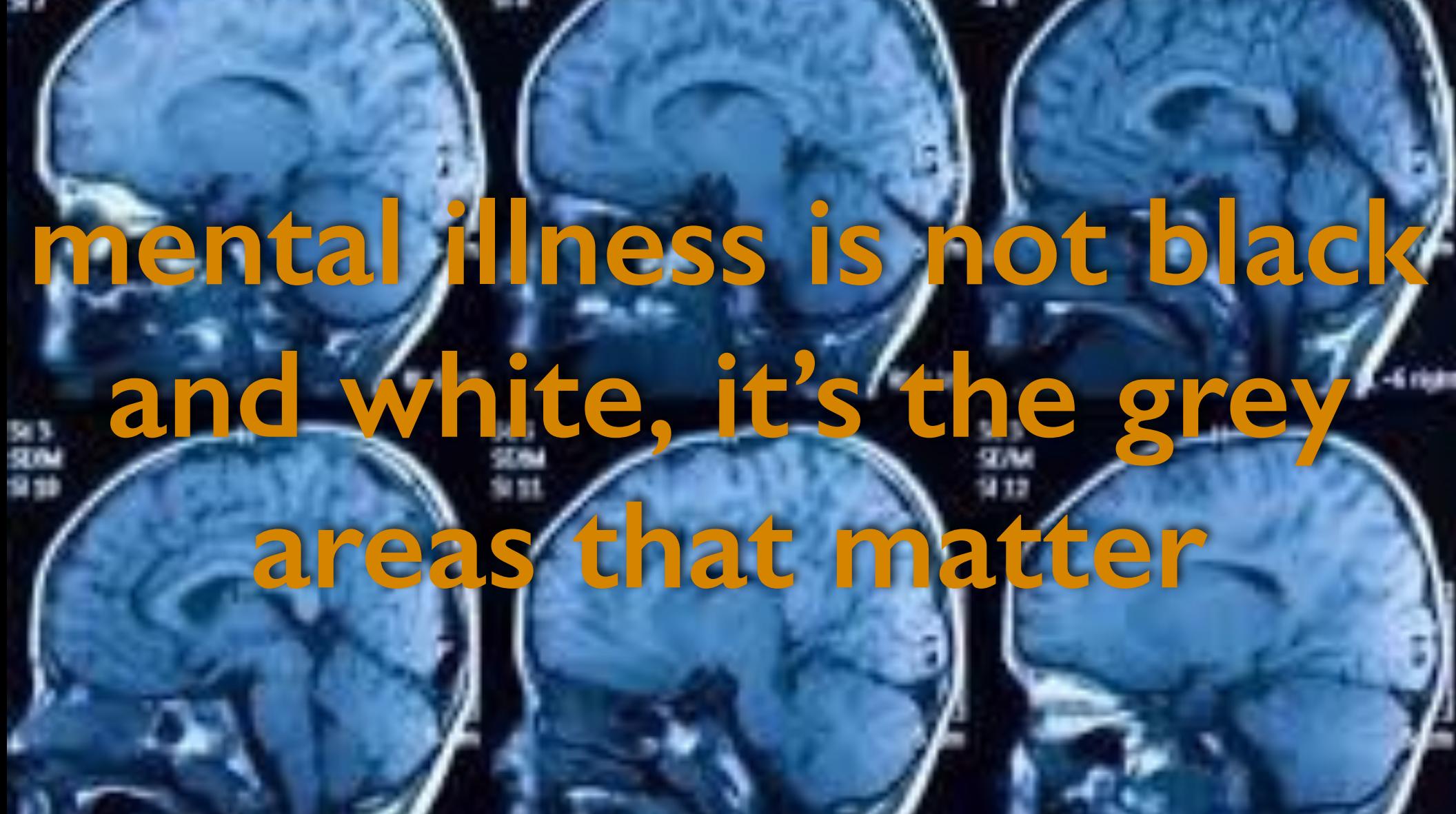
EurekaWeekly.BPRS.Report@cs.dartmouth.edu Sep 7 (1 day ago)

to Raymond.J.Walk., EGloegger, 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@eureka 147	13.6539641466	0.222493081866	0.314497682435	0.706745518321	11.1689500326	10.3872105132	8.0	20160719 8.0		1	0
u086_rct@eureka 131	11.679756919	0.153296658453	0.148953473689	0.459969614876	10.1272789038	10.1655612577	8.0	20160725 8.0		1	0
u056_rct@eureka 083	12.3407620346	0.130754572377	0.150202079796	0.762966004945	10.9137405553	10.7292120675	7.0	20160727 7.333333333333	6	0	0
u083_rct@eureka 139	9.21058072234	0.106887768844	-0.0216140478532	-1	8.32115141354	9.41405659202	-1	-1 -1		0	0
u059_rct@eureka 100	9.84447309455	0.0453892888859	-0.107123387673	0.230559136819	9.41704033054	11.0255694445	8.0	20160504 8.0		3	0
u078_rct@eureka 135	9.14926470675	0.0108577735996	0.103952199627	-1	9.05099109459	8.28773628952	-1	-1 -1		0	0
u051_rct@eureka 095	8.81621603548	0.00789464736147	0.0102251715312	0.102027004435	8.74716028958	8.72698115621	8.0	20151204 8.0		1	0
u072_rct@eureka 142	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

- ▶ RDoC Twitterfeed
- ▶ RDoC Discussion Forum

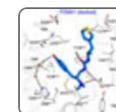
Learn More About RDoC

rise of RDoC

Learn More About...

- ▶ Highlighted Research Initiatives
- ▶ NIH/NIMH Therapeutics

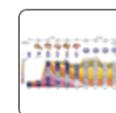
Science News



Designer analgesic optimizes specificity



Early Life Experience Matures Memory



Atlas Reveals Risk Gene Timing

+ MORE



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
pupilometry 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



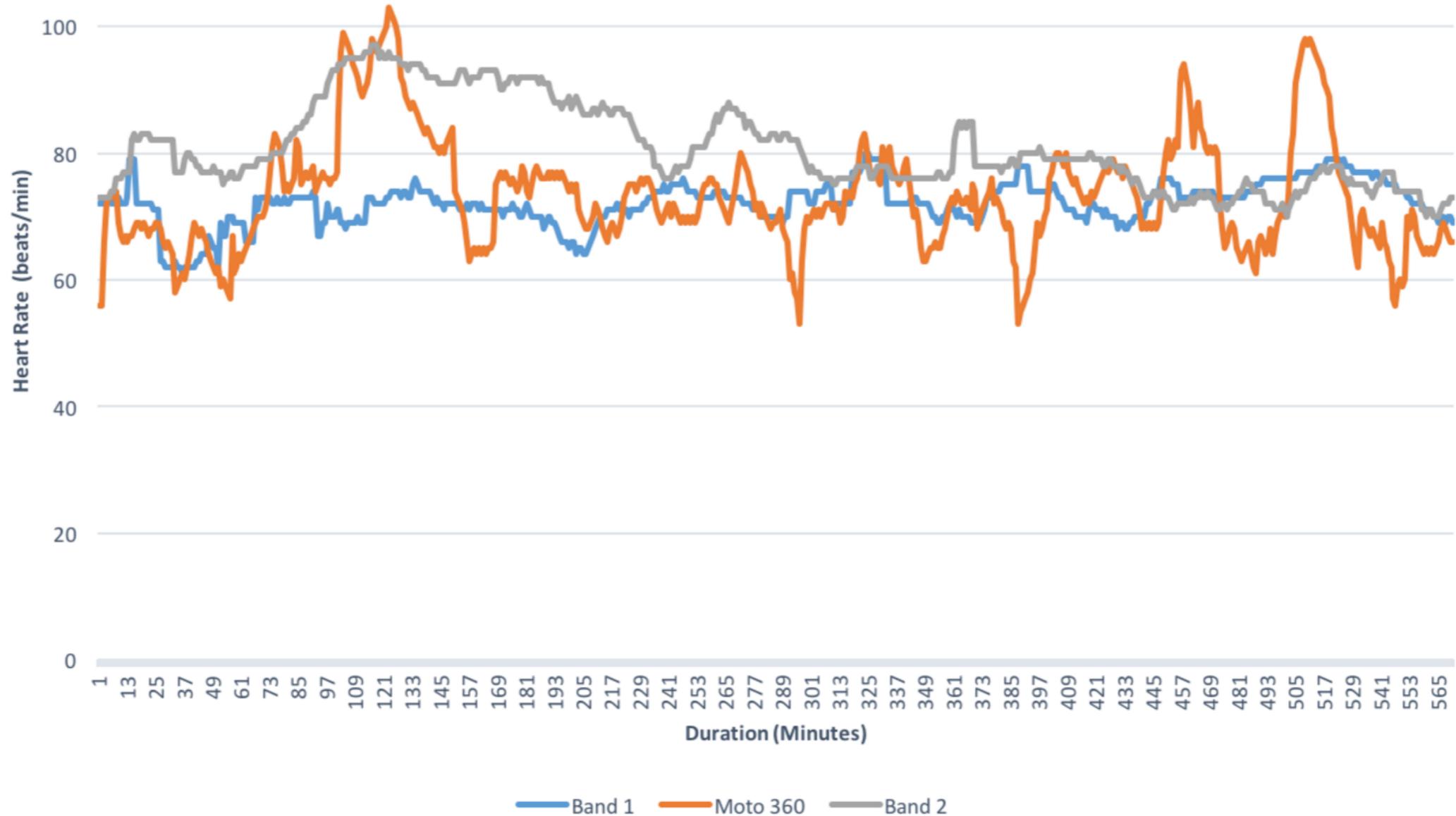
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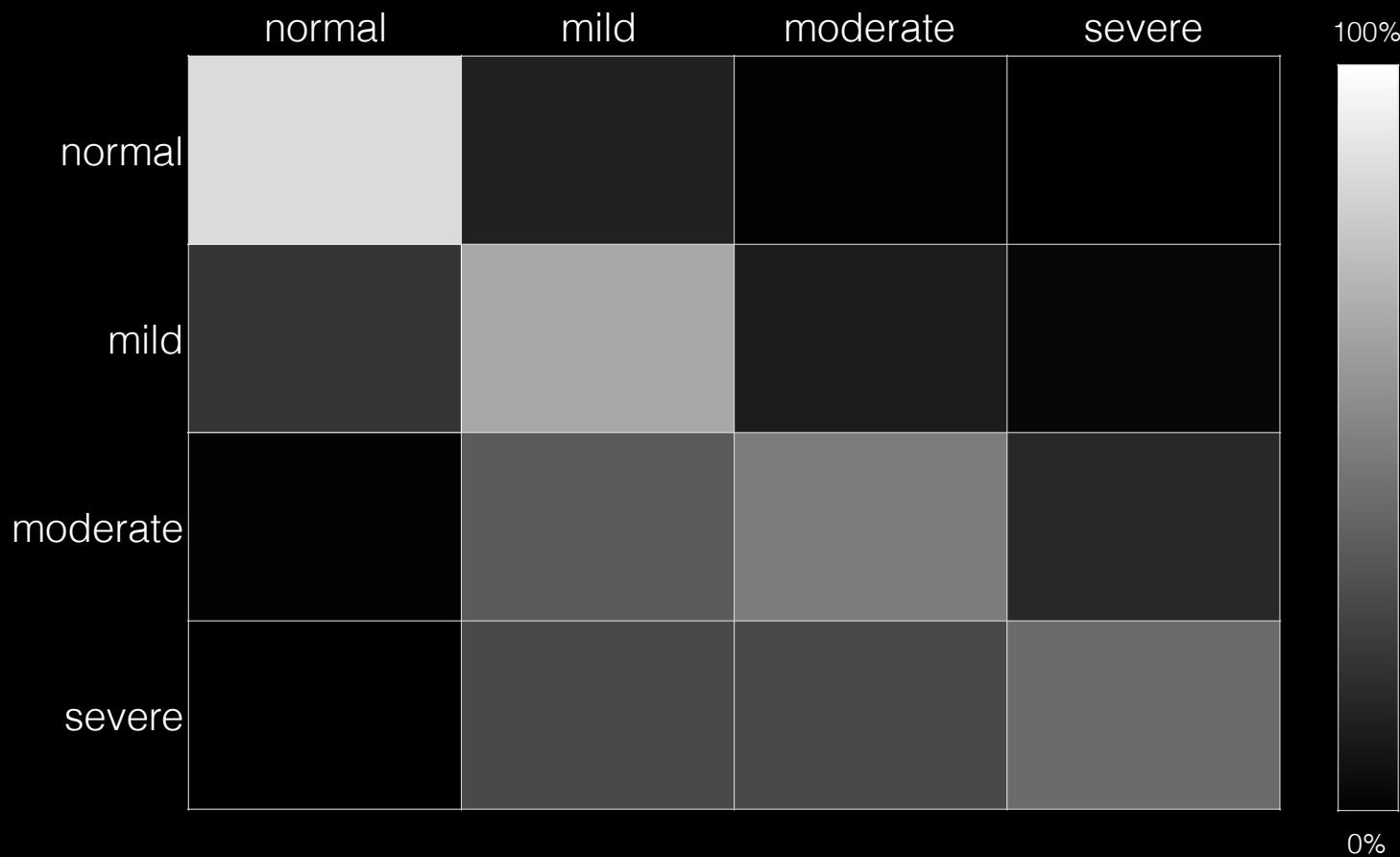


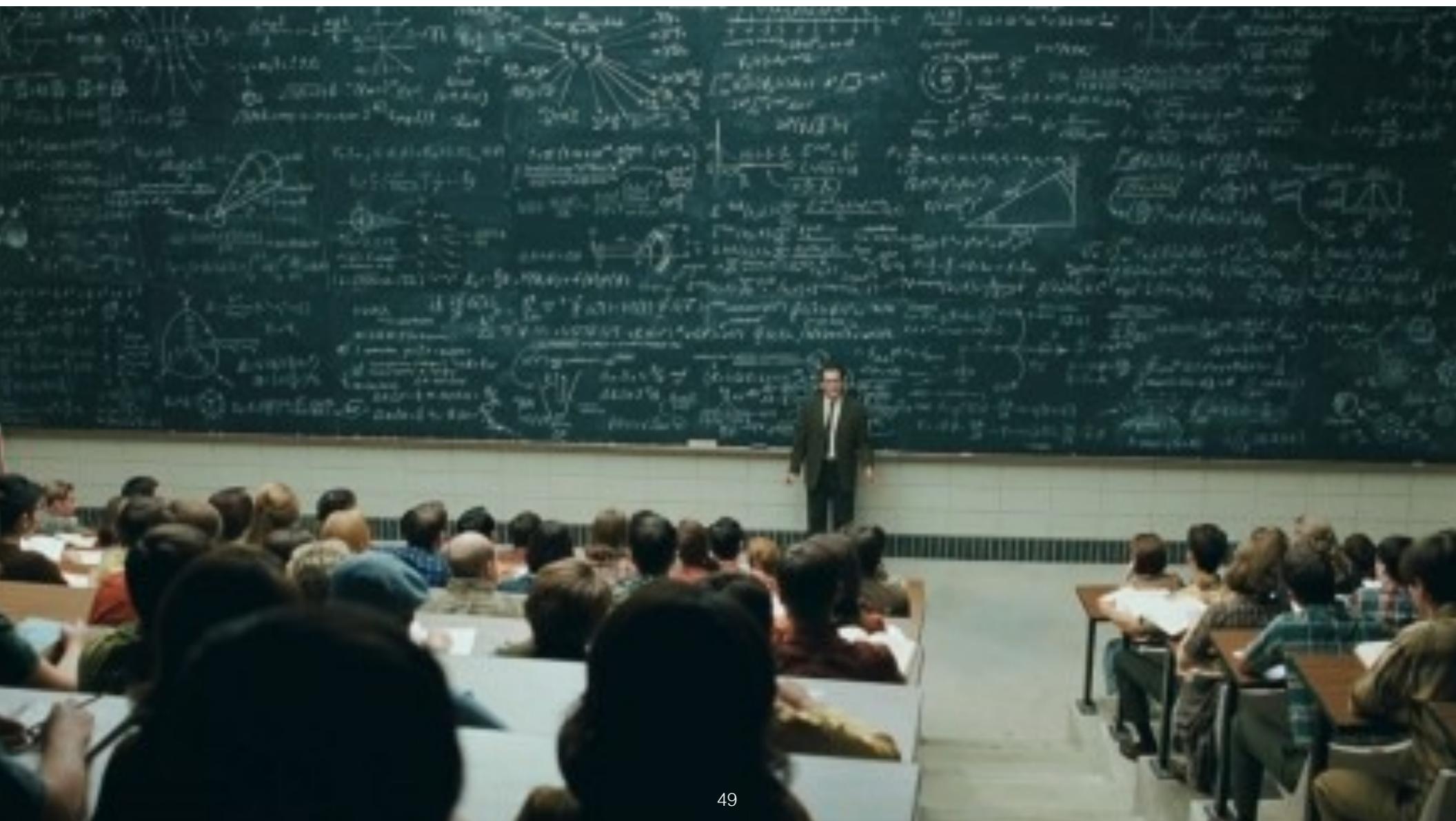
promise of wearables



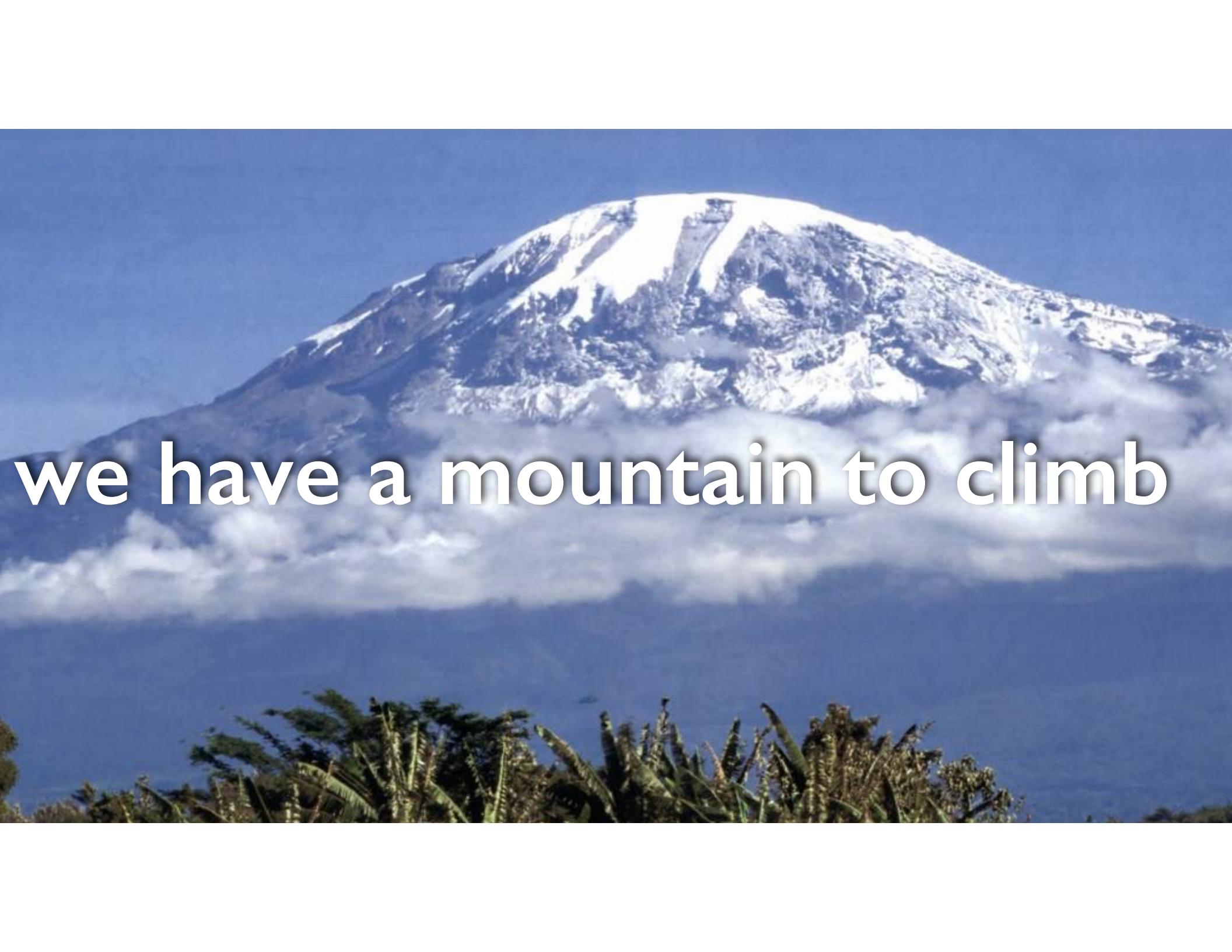


depression state transitions based on weekly PHQ4 data





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

A photograph of a majestic, snow-capped mountain peak, possibly Mount Kilimanjaro, set against a clear blue sky. The mountain's slopes are partially covered in snow and rocky terrain. Below the peak, a thick layer of white clouds obscures the base of the mountain, creating a sense of depth and scale. The overall scene is serene and inspiring.

we have a mountain to climb





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randomized
control trails



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,
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StudentLife, UbiComp, 2014

SmartGPA, UbiComp, 2015

CrossCheck, UbiComp, 2016





peace brother

